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# ASSESSMENT OF SPACE COMMUNICATIONS TECHNOLOGY

## HEARINGS

BEFORE THE

## SUBCOMMITTEE ON SPACE SCIENCE AND APPLICATIONS

OF THE

## COMMITTEE ON SCIENCE AND ASTRONAUTICS

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# CONTENTS

## STATEMENTS

# ASSESSMENT OF SPACE COMMUNICATIONS TECHNOLOGY

TUESDAY, DECEMBER 16, 1969

HOUSE OF REPRESENTATIVES,
COMMITTEE ON SCIENCE AND ASTRONAUTICS,
SUBCOMMITTEE ON SPACE SCIENCE AND APPLICATIONS,
*Washington, D.C.*

The subcommittee met, pursuant to notice, at 10 a.m., in room 2325, Rayburn House Office Building, Hon. Joseph E. Karth (chairman of the subcommittee) presiding.

Mr. KARTH. The committee will be in order. Good morning, Mr. Chairman, and welcome to our hearings.

Chairman MILLER. Thank you, Mr. Karth.

Mr. KARTH. Mr. Chairman, members of the committee, this morning the Subcommittee on Space Science and Applications opens hearings in which we intend to review the work of NASA during the past decade in the development of space communications systems, to assess the current state of the art of communications satellite technology and to examine trends and directions in this important activity.

Research and development in communications satellites was one of the first efforts in the U.S. space program. As early as December 1958, the Army Signal Corps launched a simple satellite into orbit which proved the concept. Since that time, NASA has had a series of successful experimental satellites that have thoroughly demonstrated the effectiveness, from a technical standpoint, of space communications, and which established the United States as the clear leader in this very important field.

The best example, perhaps, was the success of NASA's Syncom project which demonstrated the feasibility of the geosynchronous mode of satellite communications. This key development made it possible to abandon consideration of a much more complex and expensive medium altitude random orbit system and opened the door to a more reliable and cheaper system available in a much earlier timeframe.

Substantial investments of public money have been made in support of space communications research and development. Cumulative expenditures of approximately $250 million have been made by NASA during the past decade for various flight projects and supporting research and technology work.

During the same period, the Department of Defense has also had an aggressive communications satellite program involving large-scale expenditures. And the work is far from finished. It is probable that hundreds of millions of dollars of public money will be spent during the next decade on further research and development.

So promising have space communications appeared that a private profit-making corporation, COMSAT, was established by an act of Congress as long ago as 1962 to undertake development of a commercial operational system. Progress in the utilization of satellite technology, however, has been disappointing in certain respects. While international communications have been advanced to some degree through INTELSAT, the use of satellites for domestic purposes has been delayed and delayed. A number of Members of Congress have indicated that they believe that the utilization of this modern technology in the improvement of communications overall has lagged far behind its potential.

For this reason, the distinguished chairman of the Science and Astronautics Committee, Congressman George P. Miller of California, suggested that this subcommittee which has the responsibility for authorizing NASA's Space Applications Program each year, hold public hearings on the subject.

We intend to review in detail NASA's work in space communications systems, and attempt to determine what, if any, institutional, legal, or economic barriers may exist in Government or industry which may have inhibited the timely utilization of existing technology.

If it is true that the technical innovations and advancements achieved in our space program are not being effectively used in the interests of the American taxpayer who supports the NASA program, it seems important to throw light on the reasons.

If it is true that better, more efficient, more versatile and cheaper communications can be made available to the public through the use of satellites, as we have been led to believe, we feel that it is important to find out why and encourage their utilization.

It is noteworthy that several nations around the world are benefiting from the results of research and development conducted by the American space program. Canada has undertaken development of a domestic space communications system. France and Germany have a joint venture underway with the same goal for their region of the world. But the truth is that any nation in the free world that undertakes to establish a system of communications using satellites will draw heavily, almost exclusively, upon the technical advancements produced by the United States space program. Their satellites will be designed and constructed on the basis of years of American R. & D., and they will be launched by American launch vehicles.

Moreover, agreements have been reached, or are under consideration whereby American experimental satellites will be used to bring modern communications services to the peoples of other nations. The proposed use of ATS–F for educational purposes in India is a case in point.

Thus, it appears that the United States is in the process of exporting some of its most advanced technology, or using it for the benefit of people of other countries. This all to the good.

At the same time, however, for reasons which remain obscure, our own citizens are being deprived of the benefits of research and development performed in this country at public expense.

It is also noteworthy that although the Soviet Union got a much later start than the United States in the development of communications satellites, the Russians now have a domestic space communications system in operation which is currently being used for television as well as other types of communications.

This morning we will hear witnesses from the National Aeronautics and Space Administration and from the Office of Telecommunications Management, the Executive Office of the President.

We will explore with them the Government's policies on these matters.

Before we begin with the first witness, Mr. Willis H. Shapley, who is the Associate Deputy Administrator of NASA, I wonder if the distinguished chairman of the full committee would care to make a statement.

Mr. Chairman.

Chairman MILLER. I have nothing to add to what you have said. I realize that there is some potential conflict in committee jurisdiction that we must be very careful to avoid. After all, NASA is not an operational agency, it is one that develops these things for the use of others. I want to be careful that we do not intrude upon the jurisdiction of the committee that has jurisdiction over the operational phases of this work.

Mr. KARTH. Thank you, Mr. Chairman.

Mr. Shapley, would you proceed, please.

## STATEMENT OF WILLIS H. SHAPLEY, ASSOCIATE DEPUTY ADMINISTRATOR, NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

Mr. SHAPLEY. Thank you, Mr. Chairman.

Mr. Chairman and members of the subcommittee, I appreciate the opportunity to say a few words by way of introduction to Dr. Marsten's review of NASA's activities in satellite communications.

In the first decade of space, NASA has made notable advances in development of space communications. Reliable and versatile space communications systems were essential to the success of the Apollo system in landing men on the moon, transmitting live television all around the world, returning scientific and other data in real time, and in bringing the astronauts safely back to earth.

Major advances in communications from deep space permitted us to increase by a factor of 2,000 the data sent back by our Mariner probes to Mars in 1969 as compared to 1964. The intricate communications systems required for sending complex commands to and receiving large volumes of data from our unmanned scientific satellites have come to be taken for granted. Finally, of course, the advances in space communications technology during the past decade have laid the groundwork for the practical use of satellites for worldwide communications—the worldwide commercial system operated by the INTELSAT consortium of 70 nations and the vital communications links operated by the Department of Defense as a part of the National Communications System.

In the next decade, new capabilities for the exploration of space, advanced planetary and other scientific missions, and the realization of many practical applications of space will require that space communications technology make further major advances. The programs of the next 10 years will call for the development of techniques for high volume, broadband telemetry and communications over vast distances. Reliability, life-time, and economy must be increased by at

least an order of magnitude. These advances will require and generate technology which will be applied to satellite communications on earth. At the same time, the continuing advances we expect in our work in satellite communications technology will support requirements of our other space missions.

Because of the pervasiveness of communications requirements and the commonality of electronics and spacecraft technology throughout the space program, NASA regards its work in relation to communications satellite technology from a standpoint much broader than specific planned or potential applications of communications satellites. At the same time, we have to try to focus our work so that the technology required for the most promising applications is available and so that potential users of satellite communications have sound experimental data on which to base their decisions.

NASA's responsibility and functions in the field of communications satellites stem from the National Aeronautics and Space Act of 1958. The objectives set forth in that act which relate to our work in communications satellites include: first, the development and operation of spacecraft; second, studies of the potential benefits to be gained from, the opportunities for and the problems involved in the utilization of space activities for peaceful and scientific purposes; and third, the cooperation with other nations in these efforts.

Under the Communications Satellite Act of 1962, NASA has specific additional responsibilities relating to the establishment of a global communications satellite system, including advising the FCC and the Department of State on technical matters, cooperation and consultation with the Communications Satellite Corp. (COMSAT) and the furnishing to COMSAT of launch and other services on a reimbursable basis.

It is important to recognize that it is not NASA's role to decide what satellite communications should actually be established, when they should be established, or what the organizational, economic or regulatory arrangements should be. On these matters we consult and advise, but the decisions have to be made by other appropriate public and private institutions within the framework of our overall economic and political process.

In advancing the practical applications and use of space—in communications and other fields—NASA's role is first to develop the technology, second to conduct studies and experiments in applications of potential value, and third to encourage and assist potential users in considering the technical possibilities in relation to their needs as they see them, and in evaluating realistically the benefits and costs.

Dr. Marsten will review what we have done and where we now stand in discharging each of these functions.

As you will see, we have placed special effort on the third function during the past year, namely, to encourage and assist potential users of satellite communications to understand and evaluate how communication satellites can help meet their needs.

It is especially important that specialized uses of satellite communications—in education, in data transmission, in navigation and traffic control, for example—receive careful consideration by the specialized users themselves, by the technical community at large, and by public and private institutions at the State, local, national and in-

ternational levels. We are doing and will continue to do all we properly can to orient our efforts and use our experimental capabilities for these purposes.

NASA's prime asset in the field of space communications—which is a consequence as well as the cause of our successful work over the years—is the broadly based technical competence in space communications matters we have within NASA. This competence is frequently called upon by other Government agencies and other entities for technical advice as well as guidance on matters involving the potential application of communications satellites. Let me mention a few examples.

NASA participated actively in the recent International Telecommunications Union meeting in Geneva in preparation for the World Administrative Radio Conference (WARC) which will be held in 1971 to consider frequency allocations and other technical matters relating to space communications. NASA representatives, working closely with the Department of State, participated in the United Nations Working Group on Direct Broadcast Satellites which completed a useful background study in this area.

The Aeronautics and Astronautics Coordinating Board, one of the mechanisms for coordination between NASA and the Department of Defense, has a subpanel on communications satellites and a technical committee on communications satellites in which NASA and the Department of Defense exchange information concerning the space communications research and development programs of the two agencies and aim at avoiding duplication.

NASA is also a member of the Interdepartmental Radio Advisory Committee (IRAC) which handles the assignment of frequencies for executive branch agencies and provides a forum for the development of the executive branch positions for the forthcoming WARC.

Aside from these formalized interagency committees, NASA has also contributed significantly to ad hoc interagency groups, established from time to time, concerned with the technical, economic and policy aspects of telecommunications where space communications are involved.

An example is the task force established in August 1967, the task force on telecommunications, whose report was subsequently made public and submitted to Congress.

Additionally, NASA works closely with the Office of the Director of Telecommunications Management to provide advice and assistance in the development of national telecommunications policy where it bears upon the use or the potential impact of communications satellites. NASA plays a similar advisory role in its relations with DOT, HEW, the Departments of Commerce and State and more recently, as Dr. Marsten will discuss, with the State of Alaska.

With these introductory remarks, let me present Dr. Richard B. Marsten, Director of Communications Programs, Office of Space Science and Applications.

Let me also introduce, sitting at my right, your old friend, Mr. Leonard Jaffe, also representing the Office of Space Science and Applications.

Mr. KARTH. Thank you very much, Mr. Shapley.

The Chair recognizes at this time Dr. Marsten, to proceed with his testimony. Dr. Marsten.

## STATEMENT OF DR. RICHARD B. MARSTEN, DIRECTOR, COMMUNICATIONS PROGRAMS, NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

Dr. MARSTEN. Mr. Chairman and members of the subcommittee, we welcome this opportunity to review the NASA program in satellite communications for you. In so doing, I will review the history of the program from Echo through ATS–V, progress with ATS–F and G to date, and recent accomplishments in supporting research and technology. I will provide an overview of total program expenditures to date and will conclude with a report on the planned user experiments. I will pay particular attention to the proposed Alaskan experiment with ATS–I, the planned Indian Instructional Television (ITV) experiment with ATS–F, and the recently approved Corporation for Public Broadcasting (CPB) experiment with ATS–III.

These user experiments represent an increasingly important part of our overall program to demonstrate and evaluate new, effective uses for satellite systems in meeting our society's growing needs for communications services.

Our policy objectives as derived from the National Aeronautics and Space Act of 1958, and the Communications Satellite Act of 1962, have been stated by Mr. Shapley. In response to those objectives, we have established a number of steps—a sort of framework—through which we conduct our research and development program.

We study the requirements for and technically assess the applicability of satellites to meet future needs. We develop and flight test technology required for future communications, navigation, and traffic control, and other useful applications. We develop and conduct flight experiments on promising systems applications. Finally, we provide technical-support for U.S. management of frequency and orbit resources.

Let me now briefly review the history of our communications research and development program from the inception of NASA in 1958 to the present. NASA has developed and launched a total of eight communications research satellites in the Echo, Relay, and Syncom programs. These research flights were supplemented by two Telstar satellites developed by A.T. & T. and launched by NASA on a reimbursable basis.

Through the research and development program conducted with these satellites, a number of capabilities were developed to serve the Nation and the international community. These can be conveniently grouped into three general areas: Technology and techniques for the transmission of wide-band signals and multiple voice channels through repeater satellites; the technology required to place and maintain communications satellites in geosynchronous orbit; and the technology required for operational ground stations to work with research and operational satellites.

This early research program resulted in two follow-on programs. One, to capitalize on the technology base developed by NASA and to provide immediate benefits to the Nation and its people, was conducted by the Communications Satellite Corporation (COMSAT) on behalf of the International Telecommunications Satellite Consortium (INTELSAT).

The other, to develop the more sophisticated and complex multidisciplinary technology required for future applications satellite systems, was conducted by NASA: The Applications Technology Satellites or ATS program.

Another significant but less direct contribution of our early research program has been to the communication satellite systems launched and operated by the U.S. Department of Defense. The Interim Defense Communication Satellite program (IDCSP), and more directly the Tactical Satellite Communications (Tacsatcom) program, have drawn extensively upon the technology, both satellite and ground station, developed during the Relay and Syncom programs.

Finally, technology initially developed in our early research program has been adapted to support the video data transmission requirements of ERTS-A and B and data transmission requirements of deep space missions.

During the 4 years from 1965 through 1969, NASA has launched for COMSAT, on a reimbursable basis, a total of 10 operational satellites in three serial generations. Eight of the 10 launches were successful. One of the eight suffered a spacecraft failure. An 11th satellite is scheduled for launch next month.

As already stated, the total operating Intelsat system of today draws heavily upon the ground station and satellite technology that was developed by NASA in its earlier programs. As a result of the improved facilities developed by COMSAT, new operational services have become available.

The improved efficiency through which those services can be performed using satellites has permitted the citizens of this country to see real-time television from around the world, and to communicate with high-quality telephone circuits to Europe, Japan, and the Pacific and Asian areas at less cost than prior to the establishment of satellite systems. The Intelsat system was an integral part of the supporting network for Apollo operations, and, of course, permitted worldwide television coverage of the Apollo 11 and 12 missions.

Let me now review for you NASA's research program which built on the same technology base that was developed from Echo through Syncom: the Applications Technology Satellites or ATS program. This program, which was started in 1964, called for five satellite launches: one medium altitude gravity-gradient satellite experiment; two spin-stabilized geosynchronous satellites: and two gravity-gradient stabilized spacecraft in geosynchronous orbit.

ATS-I and III were successfully launched in 1966 and 1967 respectively. They are still being operated. Testimony earlier this year before this subcommittee discussed the launch vehicle failures on the ATS-II and IV flights, and the problems we have experienced with ATS-V.

We have obtained many important results from the wide range of experiments conducted with the successful ATS-I and III satellites. These experiments are providing the technology base for future operational satellite systems.

Generally, the communications technology experiments performed with these satellites can lead to greater capabilities for traditional communications services and possibly at reduced rates; capabilities for new services such as TV networking and community educational and

instructional television; data collection for expanded environment monitoring systems; specialized information transfer networks to serve unique user groups such as health care services; and more efficient air traffic control systems.

Two of the critical factors in the application of satellites to these new or expanded services are the efficiency with which the satellites can use the limited RF spectrum, and can convert the raw electric power generated on the satellite into radio signals which reach the receiver antenna on the ground.

On the ATS–I and III geosynchronous satellites we proved out the design of both electronically and mechanically despun antennas which permit us to confine the power expended on RF transmission to a beam covering only the earth's disk, with no wasted energy transmitted to space. This results in a 20-fold improvement in transmission efficiency over the Syncom and early INTELSAT satellites which can be directly converted into either a reduction in satellite launch weight, and thus cost, or, more importantly, into a manyfold reduction in the ground receiving and transmitting station costs.

The practicality of specialized informational networks for education, instruction or health care, or of data collection systems for environmental monitoring services may depend on continued improvements in the efficiency with which we can further narrow our antenna beams and point our satellite antennas toward selected portions of the earth's disk.

Voice and data transmission and position location experiments using these directive antennas have shown that relatively simple and inexpensive ground and aircraft equipment can work with satellites using this technology.

Another important consideration is the extent to which a large number of ground stations can use a single satellite and a single segment of the radio spectrum to communicate with each other. Experiments with ATS–I and III have contributed basic knowledge in this area.

In addition, meteorological cameras, providing both black and white and color pictures of the earth's disk every 20 minutes during daylight hours, are providing the Environmental Science Services Administration (ESSA) and our research meteorologists with a new look at our atmosphere.

Already we have been able to track the short-term behavior of devastating storm systems such as Hurricane Camille far more precisely than with medium altitude weather satellites, and in real time, permitting more timely and accurate disaster warnings.

The improved knowledge of the behavior of these major storm systems, if coupled with improved communications alert systems, could eventually prevent or minimize the shocking loss of life such as occurred in the Appalachian region following Camille. ESSA is now, in fact, using our ATS–I and III satellites in a quasi-operational fashion to improve weather forecasts, and to develop a better understanding of the way our atmosphere behaves.

While we could not expect to obtain all of the planned experiment results from ATS–V in its spin-stabilized mode, we are obtaining a majority of the planned propagation, digital communication, and ranging data in the L-band aeronautical frequency region around 1,600 mHz, and in the millimeter wave region.

The L-band data are important in evaluating the suitability of this frequency region for conducting aircraft navigation and traffic control operations. The millimeter wave data are important in determining to what extent we may use this higher, yet uncrowded frequency band to extend satellite communications services without interfering with conventional terrestrial services.

Mr. Chairman, the written testimony outlines the history of ATS–F and G in some detail. While submitting it for the record, in the interest of time I would like to proceed directly from the bottom of page 8 to the middle of page 10.

(The unread portion is as follows:)

In late 1964 and early 1965, NASA in-house studies were made of the logical extension of the ATS concepts to larger spacecraft, with greater capacity for effective radiated power and pointing precision. These studies indicated that a reasonable next step could be a spacecraft in a stationary orbit, able to radiate to—or view—selected portions of the visible earth rather than the whole earth disk.

This technology could result in a significant increase in communications, meteorology and earth resources survey capability, and concomitant improvements in services to the people of this nation—improved TV distribution and community education, safer travel, more accurate weather forecasts, and more effective management of our environment and natural resources.

The studies showed that a relatively large antenna would be required, as well as much greater stabilization accuracy than possessed by spacecraft of the previous ATS series. Thirty feet represented the largest practicable antenna size; 0.1 degree stabilization accuracy would be required to provide stable geographic coverage at the higher frequencies that are of interest for many communications applications.

This narrow beam antenna will result in a further improvement in transmission efficiency by a factor of some 300 over the whole-earth coverage patterns of the ATS–I and III satellites. The erection of a thirty-foot antenna in space was identified as the principal technological difficulty.

In May and June of 1966 three aerospace companies received contracts of approximately $150,000 each for six-month feasibility studies. Goddard Space Flight Center (GSFC) conducted its own parallel study. All results indicated that the missions could be accomplished with a 2,000-pound satellite launched by a Titan IIIC.

In February 1968, some 20 firms were invited to propose a Phase B/C definition and design study. Fairchild Hiller Corporation and General Electric Corporation were selected in September 1968 to conduct 13-month studies which called for specifications and proposals for the Phase D fabrication effort based on laboratory demonstration of feasibility of critical technologies. The contracts include a sustaining effort until the Phase D contractor is selected from the two Phase B/C contractors. We expect to select the Phase D contractor in early 1970.

As currently conceived, the ATS–F and G experimental satellites, scheduled for launch in 1972 and 1974, will prove out technologies which can be ultimately applied to provide a number of benefits.

Dr. MARSTEN (continuing). They will provide much of the prerequisite technology base for: mass instruction through TV transmission to inexpensive ground receivers; improved safety, economy, and convenience in air travel through effective air traffic control and communications; continuous contact with satellites in orbit, which is not now possible, through satellite-to-satellite tracking and communications; improved use of the crowded frequency spectrums and synchronous orbit through interference and propagation measurements and experiments; and finally, improved weather prediction through infrared measurements of the earth's atmosphere.

In February 1968 announcement was made of the experiment opportunities on ATS–F. About 60 experiment proposals were received from

over 40 organizations. In October 17 experiments were selected for ATS–F.

Now, Mr. Chairman, these are important experiments in the technology of communications, navigation, and traffic control, meteorology and basic space technology and science. They are described in detail on pages 11 and 12 of the prepared statement, and with your permission, I would like to skip that detail and proceed to the last paragraph of page 12.

(The unread portion follows:)

In the area of communications, a number of experiments were selected which relate to the problems of frequency spectrum utilization. One experiment will measure radio frequency interference in the commercial satellite frequency bands to permit us to develop appropriate criteria for sharing these frequencies between space and terrestrial uses.

Another experiment will study the basic effects of the atmosphere and ionosphere on very wide-band signals to determine what some of the basic limitations are on transmission from satellites to earth stations. We have approved two experiments designed to investigate new, uncrowded regions of the spectrum, one in the millimeter wave region and the second at laser frequencies. Both of these experiments offer possibilities for wide-band satellite-to-satellite communications in the future.

Two communications experiments were approved for ATS–F which will support continuing studies which relate to more efficient operation of NASA's tracking and data acquisition network which supports NASA's ongoing flight missions.

One of the experiments will permit tracking of and wide-band data retrieval from the Nimbus-E satellite using ATS–F, and the other would permit similar experiments with one of the Apollo applications program dry workshops.

In the area of navigation and air traffic control, we have approved for ATS–F an experiment to determine the absolute and relative accuracy of locating and communicating with moving aircraft as an important input to our navigation satellite studies.

In the area of meteorology, we have approved a very high resolution radiometer experiment, continuing the traditional support that the ATS program has provided to the earth observations disciplines. In addition to mapping cloud patterns, this sensor will provide experimental information on sea surface temperatures (and thus ocean currents) in cloud-free areas, and will provide estimates of cloud heights as well as area coverage.

A number of experiments related to basic spacecraft technology and science have also been approved. You will recall that the ATS satellites represent NASA's only opportunity to examine in detail the environment in the geosynchronous orbit.

Dr. MARSTEN (continuing).

After we have gathered a majority of the data from these experiments, particularly those that require the active participation of organizations and ground stations in the United States, we will move ATS–F to a position from which it can view the Indian subcontinent. We will then conduct—in conjunction with the Indian Government—the instructional television experiment which was the subject of the recent memorandum of understanding between NASA and the Indian space agency (Department of Atomic Energy).

A number of developments in our recent supporting research and technology program warrant brief mention.

Two studies on TV broadcast satellites were recently completed. These examined some of the technical possibilities, problem areas, and cost factors involved in transmitting both monochrome and color television program material either directly to conventional receivers, to augmented home receivers, or to relatively inexpensive community and institutional receivers for redistribution to homes and classrooms.

Further research and development to explore the limits of technical feasibility are essential in order to assure that we are in a position to develop this kind of capability, should it appear to be in the national interest.

For satellite radio frequency (RF) output powers of 100 watts and above, power level and efficiency of transmitting tubes are the major factors in determining spacecraft size, weight, and cost.

The tubes are the major source of heat to be dissipated into space and consequently RF power output devices are one of the critical components insofar as satellite lifetime is concerned. NASA is conducting research and development covering design concepts and experimental verification in the laboratory of the most promising technical approaches to high power tubes and associated componentry.

Based upon in-house studies and recommendations from an interagency committee, we held a competition for an advanced mission study of a satellite system to meet the needs of the civilian aviation and maritime community for improvements in communications, navigation, traffic control, and related functions. Twelve aerospace companies responded to our request for proposals, and RCA and TRW were selected to conduct the work.

Both companies determined that satellite systems could meet the mid-1970 needs of aircraft and ships for communications and navigation improvements. The ultrahigh frequency (UHF/L-band) part of the frequency spectrum was recommended by both companies as optimum for the required services, and both recommended a two-satellite ranging system concept for initial experimental work.

In response to a request from the Federal Aviation Administration (FAA) following these studies, a joint NASA–FAA study effort was begun in 1969 to develop plans for a one-ocean UHF satellite experiment in air traffic control. As mentioned in the recent NASA report to the Space Task Group, we have responded affirmatively to a suggestion by the European Space Research Organization (ESRO) that we examine together the technical basis for a possible experiment that might be conducted cooperatively and on a shared cost basis.

In these exploratory talks, NASA has relied on the Department of Transportation-FAA for definition of air traffic control needs in such an experiment. ESRO is similarly coordinating with the several air traffic control authorities in Europe.

An important function of our program is to provide technical support to many Government agencies and to other, outside organizations. For example, we have been called on by the Executive Office of the President for technical assistance.

Most recently, NASA was asked to design and manage a radio interference and propagation measurement program. This was initiated at the request of an interagency steering group comprising OTM, FCC, Department of Commerce, and NASA, and is jointly funded.

Initial results will provide added technical support to the U.S. position for the 1971 World Administrative Radio Conference (WARC). Results from this program should also help provide a technical base for future frequency allocation negotiations as our burgeoning communications needs take us to ever higher frequency regions in the spectrum.

We have also participated extensively in various ad hoc intragovernmental working groups concerned with communications satellite policy and technology, with particular emphasis on domestic satellite possibilities. We provide continuing technical support to the Federal Communications Commission. Advice and services are also provided to the Department of Defense, Department of Transportation, State, Health, Education, and Welfare, and Department of Commerce.

We have provided technical support services to COMSAT Corp. on a reimbursable basis. This year, also, we made significant contributions on space systems to the International Telecommunications Union, International Radio Consultative Committee meeting in Geneva by providing the principal papers on orbit utilization and space broadcasting, and to the United Nations Working Group on space broadcasting by providing the principal paper on technology and economics.

Mr. Chairman, in my written testimony figures have been provided for expenditures through fiscal year 1968 and for fiscal year 1969. With your permission, I would like simply to summarize our expenditures through fiscal year 1969.

Through fiscal year 1969 we have expended about $70 million on the early projects devoted to the demonstration of the feasibility of satellite communication, that is, Echo, Relay and Syncom. These projects were completed in 1964. Following these, our communications development efforts were executed as a part of the Applications Technology Satellite program.

ATS 1 through 5 cost approximately $139 million, of which about $21 million were for communications-related experiments, and $6 million were for navigation and traffic control experiments. In addition we have spent about $40 million in our supporting research and technology program for communications, navigation and traffic control.

Recognizing that a large portion of our initial experimental program with ATS–I and III was completed and that their continuing capability to operate represented an important resource to the Nation, NASA held a meeting on June 13, 1969, in which the capabilities and terms of availability of this resource were presented to a broad spectrum of potential experimenters.

NASA has established a policy of making the ATS satellites available for worthwhile experimentation by other organizations, after the initial technical experiments on the satellites have been completed, and for as long as the satellites remain operative.

Such organizations can include other Government agencies, educational institutions, or private concerns which are potential users of future operational satellite systems. The organizations must be willing to invest in the necessary ground facilities, provide message content, and cover other ground costs. All of the above mentioned classes of organizations were well represented at the meeting.

A great deal of interest in the ATS resource for experimentation was expressed, and a number of specific experiment proposals have subsequently been received. As an outgrowth of that meeting, NASA and COMSAT jointly developed a draft inventory of communications satellites and associated ground facilities in order to assist the user community to develop meaningful experiment proposals.

The inventory consists of the NASA ATS satellites and ground stations, and to some extent, those INTELSAT satellites and ground

stations where unused capacity is available. In combination, these and the projected ATS–F and G satellites represent a powerful tool for experimental use.

Let me now turn in more detial to the planned and proposed user experiments: First, the proposed Alaskan experiment, then the planned Indian ITV experiment, thirdly, the recently approved Corporation for Public Broadcasting experiment, and finally other proposals.

By a letter of November 12, 1969, Governor Keith H. Miller transmitted to NASA copies of the formal proposal for a Satellite Communications demonstration for Alaska. We gave guidance to the Governor's committee in the early stages of their proposal effort by providing them with information on the technical characteristics of the ATS satellites and ground stations, and by telling them what kinds of information their proposal must contain to permit us to evaluate it.

I participated in the meeting in Anchorage, Alaska, on August 28 and 29, 1969, on this subject. The needs of Alaska for improved communications services were outlined at that meeting. I provided the conference with information on the technical possibilities of experimental use of the ATS satellites in exploring the potential role of satellites in meeting those needs.

In substance, the Alaskan proposal for the use of ATS–I calls for transmission of instructional and other public television programing from Fairbanks to three relatively heavily populated areas, and of educational radio programs to many more remote areas. Planning and preliminary systems design and site selection have already been started by the State of Alaska.

It is proposed that television programing and the television transmitting station be located in Fairbanks, close to the University of Alaska. Television receiving stations would be located at Kodiak, Nome, and Fort Yukon, representing a variety of geographical areas and population groups.

The proposed TV programing would include instructional and preschool educational programs, public and general informational programs and medical and public health information.

According to the proposal, VHF radio transmitting stations would be located initially at the University of Alaska, Anchorage, and Juneau. The radio programs could be received in a number of remote areas in addition to the more heavily populated regions, since antenna and receiver costs are much less than for TV reception. The radio programs would be aimed toward educational purposes such as native language training, and health and sanitation practices. Additional two-way radio tests are planned relating to public safety.

According to the proposal, the State of Alaska would bear the cost of development of the programing, the conduct and the evaluation of the experiment. Ground stations would be provided by COMSAT and RCA Global Communications, Inc., with Alaska sharing the cost of installation. NASA would provide the use of the ATS–I satellite, including the normal housekeeping and operations of the satellite.

Planning has already been started by the State of Alaska, with a target date of March 1970 for the beginning of radio transmission and October 1970 for the beginning of television transmissions. Proposed transmission schedules would total some 7 hours per day, shared between radio and television programs.

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The proposal calls for the continuation of the experiment throughout a full school year, that is, through the spring of 1971, subject, of course, to continued satisfactory operation of ATS–I.

We anticipate that the technical details of NASA's involvement can be satisfactorily worked out, and, subject to that, that formal NASA approval of the proposal will be forthcoming in the near future.

Let us turn now to the planned Instructional Television experiment with India using ATS–F.

The potential ATS–F and G capabilities were discussed within the forum of an international committee on satellite communications experiments which NASA has used since the early experiments with Relay and Telstar. India became particularly interested in the potential for television transmissions to remote areas for instructional purposes, such as methods to increase agricultural output, and for population control.

They proposed a joint study of the possibilities of an experiment to test the utility of such techniques in a letter in 1966. Preliminary discussions led to an agreement for a joint study in October of 1967. The focus of this study was on an assessment of the comparative costs and effectiveness of space and nonspace systems, a definition of the technical objectives and of the recommended ATS–F experiment, a concise definition of the commitments required of NASA and the Indian Government, and a recommendation of further actions. The joint study was completed this past June.

India is particularly suited for an experiment of the type planned for ATS–F. The population is distributed fairly evenly throughout the country, rather than being concentrated in a few large cities which could be reached easily by terrestrial television distribution methods. There is no existing TV distribution network, and the Indian subcontinent is of a convenient size relative to the antenna pattern of the ATS–F satellite. A ground station suitable for transmission to the ATS–F satellite is already available in Ahmedabad.

Dr. Vikram Sarabhai, chairman of the Indian Space Research Organization and the Department of Atomic Energy, views the potentialities of the experiment as "truly staggering" for Indian national development programs, as a forerunner of future systems for bringing together all of India with one information and communication system.

Most of India's half million villages are severely isolated from each other and from the rest of the world. Despite the high priority of education, the country still has a wide base of illiteracy. Dr. Sarabhai has emphasized the roles of information and the motivation of the farmer, in a society such as India, in making life in smaller communities more meaningful, richer, and more livable, and in contributing to national cohesiveness by bringing the culture of the country to every citizen of India.

The key provisions of the more recent agreement signed by both parties on September 18, 1969, can be summarized as follows:

India has accepted responsibility for procuring and installing about 5,000 widely distributed village receiving systems, for all TV programing material, and for obtaining all necessary international frequency clearances. They will transmit TV programs from their

earth station to the satellite. They will assume all costs associated with the ground segment, programing, training, and analysis. They will evaluate the results of the experiment, in quantitative terms where possible, and will report all findings to the international community.

NASA has accepted the responsibility for providing an 80-watt transmitter on ATS–F and positioning the satellite within view of India within 1 year of launch; providing experiment time of up to 6 hours per day for a period of approximately 1 year; and making available training and consultation.

With your permission, I will submit for the record at this point copies of the October 1967 agreement and the September 1969 agreement.

MEMORANDUM OF UNDERSTANDING BETWEEN THE INDIAN DEPARTMENT OF ATOMIC ENERGY (DATE) AND THE U.S. NATIONAL AERONAUTICS AND SPACE ADMINISTRATION (NASA)

The Indian Department of Atomic Energy (DAE) and the United States National Aeronautics and Space Administration (NASA) have jointly considered the facts that: (1) NASA plans, subject to funding and authorization, to launch an experimental Applications Technology Satellite (ATS F/G) in the synchronous equatorial orbit in the early 1970's; (2) the satellite with some feasible modification might be used to transmit TV signals, to augmented conventional receivers; (3) the Indian Department of Atomic Energy has established, at Ahmedabad, an Experimental Satellite Communication Earth Station; and (4) the Government of India is also deeply interested in the use of TV as a medium of mass communication for implementing programs for development; and has, among other things, organized a Pilot Project in Delhi aimed to test the effectiveness of TV for improving agricultural productivity.

Having mutual interest in the possibility of utilizing such a satellite to conduct an experimental instructional TV project, the two agencies agree, subject to confirmation through a subsequent exchange of letters, to constitute a NASA/DAE Joint Study Group to investigate the feasibility and desirability of such a project.

The composition of the Joint Study Group should include not less than four members from each side. Each agency should nominate a co-chairman. The group should reflect in its membership, and in such advisors and consultants as each side engages, experience in the fields of electronic engineering, broadcasting, telecommunications, manufacturing, education, economics, and systems analysis.

The terms of reference of the Joint Study Group shall include, but are not necessarily limited to, the following:

(1) To state the educational objectives of possible ITV experiments.

(2) To assess the comparative costs and the effectiveness of space and nonspace systems in meeting such objectives.

(3) To state the technical and educational objectives of a possible satellite ITV experiment.

(4) To define a recommended experiment based on the possible use of ATS F/G experiment opportunity. This definition should include as a minimum:

a. A description of the space segment including frequencies, effective radiated power, weight, physical volume, power requirements, available lifetime, and costs.

b. A description of the ground segment and its cost.

c. The requirements for compatibility of the space and ground segments.

d. The optimum operational requirements of the ground segment, including number of receivers, grade of service desired, logistics and maintenance, and methods of maximum audience exposure.

e. Duration, time-phasing, and scheduling of the experiment.

f. The relationship of the character of the facilities and resources created by the proposed experiment to possible future opreational services.

g. General character of the ITV programming format and content planned by India for this experiment.

(5) To define the extent of the commitments of the parties.

(6) To report its final conclusions and recommendations to the respective agencies on or before January 31, 1968.

Both agencies agree that the constitution of a Joint Study Group does not commit either side to the acceptance of its recommendations nor to the conduct of any specific experiment.

Each agency will bear all the expenses of its part of the Joint Study Group operation including salaries and travel of its members and any advisors and consultants it may wish to utilize or which the two sides agree jointly to utilize.

All ancillary materials, studies and records developed by the Joint Study Group, shall be freely available to both agencies.

The modus operandi of the Joint Study Group shall be as agreed between co-chairmen. In view of the relatively small size of the group, it is anticipated that maximum use will be made of advisors and consultants both in India and the United States. It is contemplated that meetings of the group will be held in both countries and that maximum use will be made of correspondence as a medium for conducting the business of the Joint Study Group.

———— ————,
*For the National Aeronautics and Space Administration.*

———— ————,
*For the Indian Department of Atomic Energy.*

Date October 2, 1967.

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MEMORANDUM OF UNDERSTANDING BETWEEN THE DEPARTMENT OF ATOMIC ENERGY OF THE GOVERNMENT OF INDIA AND THE U.S. NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

BACKGROUND

1.0 The Department of Atomic Energy of the Government of India (DAE) and the United States National Aeronautics and Space Administration (NASA) have jointly considered the fact that NASA plans, subject to funding and authorization, to launch two experimental Application Technology Satellites (ATS F and G) in the early 1970's. These satellites, to be placed in a synchronous equatorial orbit, have among their principal objectives exploration of the technical feasibility of erecting a large (30 foot) antenna structure in space and the ability to point it accurately ($\pm 0.1°$). Planned for inclusion on the ATS satellite is an UHF FM transmitter which could be used to transmit one video and two audio channels to augmented conventional TV receivers. Other experiments will likely include meteorological, navigation and communications applications and scientific experiments in the space environment.

1.1 The Government of India has organized a Pilot Project in Delhi to test the effectivenes of TV for improving agricultural productivity, and is also deeply interested in the use of TV as a medium of mass communication for implementing programs for development. In addition, the DAE has established at Ahmedabad, an Experimental Satellite Communication Earth Station. As a result of these activities and interests, the DAE has considered with NASA the feasibility and desirability of conducting an instructional TV experiment utilizing the experimental ATS F satellite, which has been independently planned and programmed by NASA for other purposes which would proceed without regard to the specific Indian application discussed here.

1.2 The final report of the DAE/NASA Joint Study Group dated June 8, 1968 recommended that the DAE and NASA proceed to agree to such an experiment.

TITLE

2.0 The experiment with which this Memorandum of Understanding is concerned shall be known, and referred to, as the India/US ITV Satellite Experiment Project.

BASIC PURPOSE

3.0 The DAE and NASA agree to use their best efforts to conduct an experiment in the use of ATS F for direct broadcast to rural community receivers and limited rediffusion through VHF transmitters of Indian-developed instructional TV program material.

GENERAL OBJECTIVES

3.1 The general objectives of the experiment will be to:

Gain experience in the development, testing and management of a satellite-based instructional television system particularly in rural areas and to determine optimal system parameters.

Demonstrate the potential value of satellite technology in the rapid development of effective mass communications in developing countries.

Demonstrate the potential value of satellite broadcast TV in the practical instruction of village inhabitants.

Stimulate national development in India, with important managerial, economic, technological and social implications.

SPECIFIC OBJECTIVES

3.2 *Indian Instructional Objectives*

3.2.1 *Primary*

Contribute to family planning objectives.
Improve agricultural practices.
Contribute to national integration.

3.2.2 *Secondary*

Contribute to general school and adult education.
Contribute to teacher training.
Improve other occupational skills.
Improve health and hygiene.

3.3 *Indian Technical Objectives*

Provide a system test of broadcast satellite TV for national development.

Enhance capability in the design, manufacture, deployment, installation, operation, movement and maintenance of village TV receivers.

Gain experience in the design, manufacture, installation, operation and maintenance of broadcast and/or distribution facilities to the extent that these are used in the experiment.

Gain an opportunity to determine optimum receiver density, distribution, and scheduling, techniques of audience attraction and organization, and to solve problems involved in developing, preparing, presenting and transmitting TV program material.

UNITED STATES TECHNICAL OBJECTIVES

3.4 Test the design and functioning of an efficient, medium-power, wideband space-borne FM transmitter, operating in the 800–900 MHz band and gain experience on the utility of this space application.

GENERAL EXPERIMENT PLAN AND RESPONSIBILITIES

4.0 Following initial NASA experimentation with ATS–F, NASA would use its best efforts to position the satellite within view of India as early as possible to permit its use for the duration of this experiment. NASA will maintain control of the satellite while the use of the satellite for the ITV experiment will be under the exclusive control of India. The appropriate authorities of the Government of India shall be solely responsible for the coordination of radio frequencies, earth to satellite and satellite to earth, insofar as this experiment, India and the surrounding region are concerned, in the framework of frequency coordination established in the International Telecommunications Union.

4.1 It is understood by DAE and NASA that the space segment responsibilities of NASA under this agreement do not go beyond the provision of experiment time on the satellite for approximately one year; no continuing responsibility is implied.

4.2 The DAE will arrange for the transmission of instructional TV programs from its earth station at Ahmedabad to the satellite for broadcast to appropriate receivers provided and sited by Indian agencies in villages in India. The number of receivers contemplated is approximately 5,000, to be widely distributed. The actual figure may, however, be less depending upon experience with ground terminal costs. Responsibility for the TV programming is entirely with India and the use of the satellite would be in conformity with the specified objectives spelled out in paragraph 3.2. The Government of India shall be solely responsible with respect to any legal proceedings which may be brought regarding such TV programs, and shall hold the Government of the United States harmless therefrom.

4.3 The DAE and NASA recognize the possibility of utilizing the Ahmedabad earth station for monitoring the performance of the experimental satellite and for its station-keeping, and the DAE agrees to make this facility available to NASA for this purpose and further agrees to make available to NASA any data received from the satellite. While the DAE would not charge NASA for such use of the Ahmedabad earth station, costs incurred in making data available, such as the costs of purchase and transportation of tapes, would be met by NASA. The DAE and NASA also recognize the possibility of utilizing the Ahmedabad earth station for the purpose of conducting NASA-programmed scientific and technological experiments. These would be conducted on a time available basis and as mutually agreed.

RESPECTIVE SCIENTIFIC RESPONSIBILITIES

4.4 The DAE will use its best effort to:

(1) Develop, provide and maintain in service the ground segment of the TV satellite experiment system that will carry out the technical objectives of the experiment.

(2) Develop and utilize ITV program materials that will carry out the instructional objectives of the experiment.

(3) Develop and implement a mutually acceptable experiment evaluation plan.

(4) Prepare and publish interim progress reports at six-month intervals and a final report within 18 months of the end of Phase III (see explanation of phase below).

(5) Make available trainees for such training as may be agreed to between Program Managers.

(6) Receive, record, reduce and analyze such ancillary engineering data as may be agreed between Program Managers.

4.5 NASA will use its best efforts to:

(1) Place into geostationary orbit an experimental Applications Technology Satellite (ATS-F), position it within view of India after a period of time, to be determined by NASA, but not greater than one year, and maintain it on station for approximately one year. The time required of the ITV experiment, which is hoped to be about 6 hours a day, will be made available for the experiment during this period as NASA continues its own experimental effort using the satellite. It is recognized that in practice power limitations in the satellite may require a reduction in the time available to approximately 4 hours.

(2) Provide to the DAE such training and consultative services as may be agreed to between Program Managers.

PHASING OF THE EXPERIMENT

5.0 *Phase I: 1969–70.*—India will undertake necessary improvements to the earth station at Ahmedabad. Research and development will continue on the design, prototyping, manufacture and testing of ground segment components. The Indian technicians involved will become familiar, to the extent necessary, with space segment characteristics. NASA will supply technical assistance and advice during this phase as agreed to between Program Managers.

5.1 *Phase II: 1970–71.*—Phase I activities (which include the Delhi experiment) will continue and intensify. This would provide new centers of expertise, uncover and solve operational problems, permit experiments with different approaches, and develop a cadre of personnel for the next phase in receiver deployment and maintenance and in programming.

5.2 *Phase III: 1972–73.*—The parties will conduct an instructional TV experiment using the ATS F satellite.

EVALUATION PLAN AND REPORT OF EXPERIMENT RESULTS

6.0 An essential element of the experiment is in its prompt and objective evaluation—wherever possible in quantitative terms—so as to provide maximum and timely information, available to all nations, that might be relevant to any future experiment or services in this area.

6.1 The DAE will develop a plan for evaluating this experiment quantitatively to the mutual satisfaction of the Program Managers. The results of this experiment will be made freely available.

EXPECTED SYSTEM CHARACTERISTICS

7.0 The expected ITV satellite experiment characteristics are as follows, subject to minor modification as may be agreed to between Program Managers:

SPACE SEGMENT

7.1 The ATS F satellite would be positioned within effective operaitonal view of India for the purposes of this experiment, in synchronous equatorial orbit, with the 30-foot parabolic antenna pointed generally toward the center of India. An FM transmitter operating in hte 800–900 MHz frequency range, with an RF bandwidth of approximately 30 MHz, will provide adequate power (80 watts) for transmitting TV program material and two audio channels to augmented conventional TV receivers.

GROUND SEGMENT

7.2 In this experiment it is assumed that the up-link transmission to the ATS F satellite would be in the 4 to 6 GHz band. The experimental satellite communications earth station will be used for transmitting ITV program material to the satellite and for monitoring these transmissions and the performance of the satellite during the duration of this experiment. Augmented conventional TV receivers would be capable of receiving monochrome TV transmission from the satellite and one of two audio channels transmitted. For this purpose, the conventional receivers would be augmented by a front end, viz. a small parabolic receiving antenna (7–10 foot) and a preamplifier FM to AM converter of sufficient quality to receive transmissions from the satellite. In high village density areas, transmission from the satellite could be received for rediffusion from VFH TV transmitters to conventional TV receivers located in villages. An additional receive-only facility, using a 20 to 30 foot parabolic antenna is required near the VHF TV transmitter.

ENGINEERING AND EXPERIMENT DATA

8.0 All data relative to this experiment should be made available to both the DAE and NASA and should be processed as soon as possible.

OPERATIONAL COORDINATION

9.0 DAE and NASA agree to designate a Program Manager who shall be individually responsible for the respective responsibilities of their agencies and jointly responsible for coordination and mutual agreement where required.

9.1 DAE and NASA agree to designate a Project Manager to coordinate agreed functions and carry out detailed day-to-day project requirements. Project Managers will constitute a Joint Project Working Group of suitable size and composition to assist in supervising the project.

INDIVIDUAL FUNDING

10.0 DAE and NASA will each meet all costs associated with its own participation and there will be no exchange of funds.

APPLICATION OF SUPPLEMENT OF MARCH 10, 1966

10.1 Both parties agree that the provisions of the Supplement to the Memorandum of Understanding of July 1, 1965, dated March 10, 1966, pertaining to the procedures for payment of travel and subsistence costs will be applicable to this project.

PUBLIC INFORMATION

11.0 In general, public news releases will be coordinated between DAE and NASA prior to release. If the information pertains solely to the participation of one of the parties, it may be released after informing the other party. However, if the interests of the other party are involved, such news releases will be coordinated with the other party. Basic "replies to queries" and press releases will be mutually developed as soon as possible and from time to time during the life of the project, so as to provide continuous up-to-date mutually-agreed public information materials.

PARTICIPATION

12.0 The experiment is to be conducted on the basis of this Memorandum of Understanding. The involvement of agencies or personnel from other nations or international bodies shall be subject to the prior agreement of DAE and NASA, and the provisions of this Memorandum of Understanding shall apply *mutatis mutandis* in such participations.

TERMINATION DATE

13.0 If the project provided for in this agreement is not substantially under way by January 31, 1975, it shall terminate on that date, unless both agencies mutually agree to an extension.

_____,
*Secretary to the Government of India,*
*Department of Atomic Energy.*

_____,
*Administrator, United States National Acronautics and Space Administration.*
Date: September 18, 1969.

Dr. MARSTEN. In summary, NASA is participating at modest cost in a very substantial and significant cooperative communications experiment. The results of this first use of broadcast satellites will contribute to a better understanding of the potential effectiveness of satellite systems in meeting communications, education, and overall economic and social needs throughout the world.

The results will be freely available and will be potentially applicable to many other situations, including future satellite distribution systems—whether for Alaska or the sparsely populated Rocky Mountain region, or for other countries, such as Brazil.

Turning once again to domestic experiments, at the meeting on June 13, 1969, the Corporation for Public Broadcasting submitted experimental proposals. These proposals were discussed with them and a modified proposal, submitted by them, was subsequently approved. The experiment is scheduled to begin this week.

The experiment calls for the transmission on a pilot basis of noncommercial television programs provided by the CPB at NASA's Rosman ground station. The programs will be relayed for 3 hours each evening from Sunday through Thursday by ATS–I or ATS–III to NASA's Mojave, Calif., ground station.

Land lines will carry the signals to Los Angeles, Calif., where they will be broadcast by public television stations on the west coast. The duration of the experiment will be up to 1 year, depending on the availability of the ATS satellites, and a supplementary experiment may be added to provide for radio program transmission during daytime hours.

We are to coordinate the CPB experiment schedule with those proposed by the Governor of Alaska and the broadcast networks, since in some cases the experiments are mutually supporting, and in any event, we must arrange an integrated schedule for the ATS satellites and ground stations.

Now, Mr. Chairman, the interests of many other users are described on page 25 and the top of page 26 of the prepared statement. Since there is little experiment detail provided on those pages, I would like now to turn to my concluding remark on page 26.

Mr. KARTH. If you don't mind, I think that the user interests might be of special interest to the committee.

Dr. MARSTEN. Fine, if you prefer me to read them, I will read them.

Mr. KARTH. Thank you.

Dr. MARSTEN. Rather than cover the balance of the user interest (as expressed by their proposals) in the same detail, let me merely cite the organizations that are involved to show the breadth of the interest that has developed as a result of the announced availability of this experimental resource at the June 13 meeting. These user contacts span the range from mere requests to be kept informed of progress to specific detailed proposals that are currently under review.

We have received a proposal from ABC and expect proposals from CBS as well as from two CBS-affiliated stations in Idaho. At the request of CBS we have cooperated in a preliminary test transmission from Rosman through ATS–III to the Hughes Aircraft Co. ground stations on the west coast.

We have expressed interest in the types of experiments proposed by the Lister Hill National Center for Biomedical Communications of the National Institutes of Health, National Library of Medicine. We have recently received a proposal from the University of Hawaii covering a broad spectrum of experiment possibilities, both to serve Hawaii and to involve the whole Pacific area.

The Canadian Broadcasting Corp., the NAVSAT Corp., Western Union International, and Governor Kirk of Florida have all indicated some degree of interest in the possibilities of experimentation with the ATS satellites. We have also exchanged correspondence with Brazil prior to the June 13 meeting regarding the possibility of cooperative experiments using the ATS–F or G satellites.

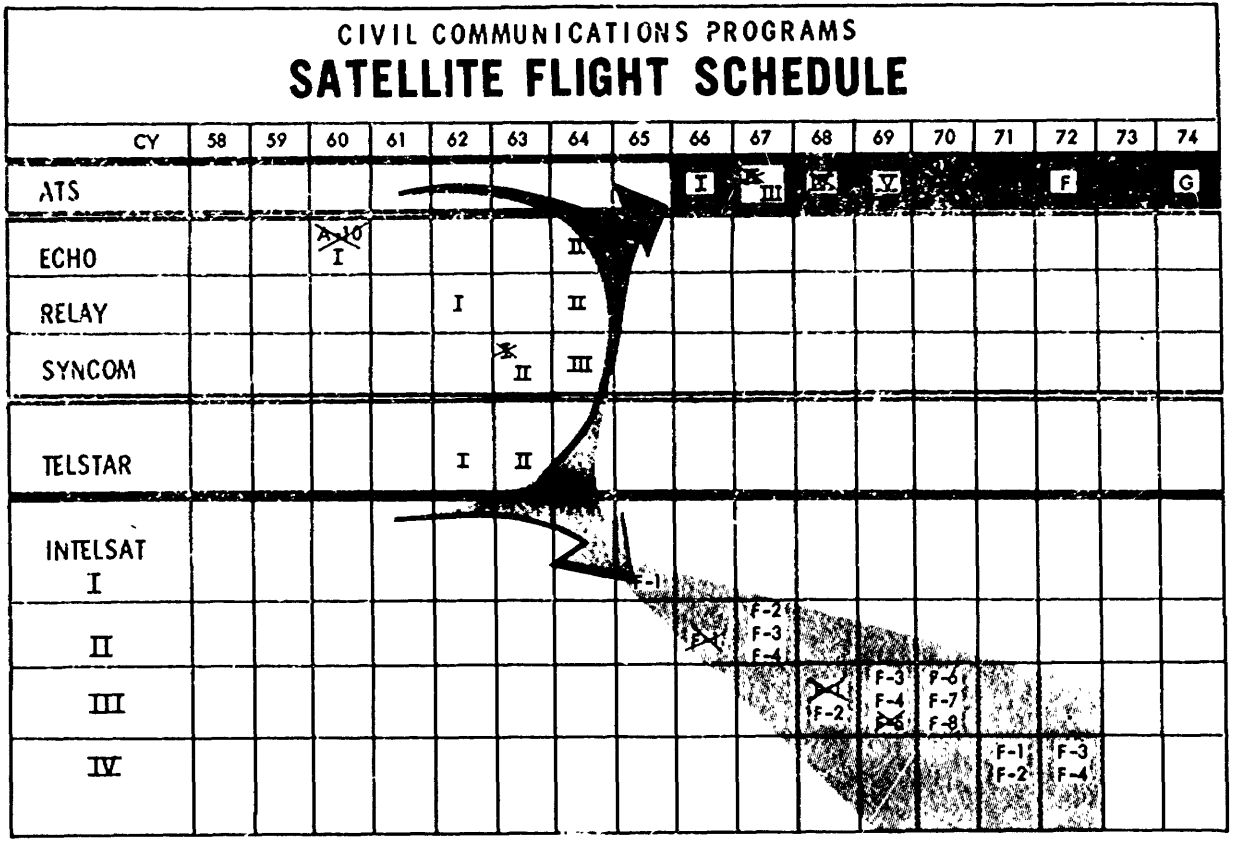
For these user experiments, NASA is authorized to operate only its own ground stations with the ATS satellites. In the case of user experiments which involve other ground stations, successful proposers must make necessary arrangements with the FCC for licensing.

In conclusion, Mr. Chairman and members of the committee, the emphasis on user experiments within the communications program demonstrates NASA's awareness of the many potential uses for civil communication satellite systems. User experiments help both to determine operational characteristics for particular uses, and to determine the technical characteristics of satellite systems appropriate to such uses.

In order to plan for and implement those technical developments required by newly recognized uses, and in order to perform systems and technology studies necessary for the definition of new communications systems and services, we must maintain a continuing, independent capability in space communications research and development. This capability forms the technical base for identification and satisfaction of future communications needs.

Mr. Chairman, this concludes my prepared statement. Thank you.

(The satellite flight schedule follows:)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LAUNCH FAILURE

Mr. KARTH. Thank you very much, Dr. Marsten. I think your statement indicates very clearly NASA's deep interest and excellent work in advancing this technology for the benefit of the American people and other peoples around the world.

Dr. MARSTEN. Thank you, Mr. Chairman.

Mr. KARTH. Thank you very much for a very informative statement. Mr. Chairman.

Chairman MILLER. Dr. Marsten, I want to congratulate you on that statement. It was both interesting and illuminating. And I am going to use your paper as a basis for speeches I have scheduled to help explain the values of the national space program.

I would like to say in passing that I was very happy that you made reference to Echo. Echo seems a long way back, but if we compare it with the area that Mr. Symington and I are familiar with, it was the wagon train, similar to the wagon trains that left Missouri for the west coast.

It is interesting that it took nearly a hundred years to perfect transportation systems across half the continent. Echo, whose life is about 10 years, I believe, has pioneered what you have done today. I am glad to see someone recognized the poor old balloon that we all watched traveling through space.

Tell me, you mentioned work in Alaska. Will the Northern Lights give you any interference?

Dr. MARSTEN. I don't know that yet, Mr. Chairman.

Chairman MILLER. You don't know that yet.

Dr. MARSTEN. This is something that we will have to evaluate as we go. And I think, recognizing that the Alaskan proposal is for an operating experiment, and one of our objectives is to determine technical requirements for operational systems, we should be aware of just such questions.

Chairman MILLER. Thank you very much.

Mr. KARTH. Thank you, Mr. Chairman.

Mr. Pettis.

Mr. PETTIS. Mr. Chairman, I don't know which one of the gentlemen may want to answer this question, but I have a question that I would like to ask. Is it true that the communications between NASA offices and other agencies has on occasion been rather poor?

For example, I have heard that neither the FAA nor the ATS office, within OSSA, was aware of the OART/ERC decision to replace the unusable experiments aboard ATS-5, with similar ones aboard aircraft.

Dr. MARSTEN. The ERC activity in L-band experiments on ATS-5 was very closely coordinated with my office. The people from ERC who were looking into the possibilities involved in replacing those experiments or in conducting other experiments have been in contact with us, and with the ATS-5 principal investigator, approximately every other week.

We have known when they have seen prospective contractors. They have known when we have seen prospective contractors. And we have had copies of the same proposals submitted to both headquarters and those contractors. We have been in close discussion with the portion of the FAA that has been involved in the aircraft parts of the L-band ATS-5 experiments.

The discussions have taken the form of what could be done with the spinning ATS–5, what data we could fairly confidently expect not to get because of the spin, how to modify the aircraft experiments to maximize the data that could be obtained, and whether in fact it should be necessary to replace ATS–5 with another satellite.

At present we are planning another meeting with the FAA, and the ERC people are usually involved in such discussions. At the last exploratory talks with ESRO, this subject also came up. FAA people, ERC people, NASA-Goddard people, including the principal investigator on ATS–5, the ATS project office and headquarters were all represented.

Mr. PETTIS. Thank you.

Mr. KARTH. Mr. Downing.

Mr. DOWNING. Thank you. I am so overwhelmed with information I don't know what question to ask. What do you think is the most dramatic application in this field to the public?

Dr. MARSTEN. Well, Mr. Downing, I feel almost as though you are asking me to sell a little bit.

Mr. DOWNING. I really think that is what we have got to do.

Dr. MARSTEN. Well, I am enthusiastic about a number of applications. I think the application of community broadcast, whether it be in television or radio form, is a very dramatic service that we could provide to areas where they do not now have ready access to modern material of whatever form.

Mr. DOWNING. Well, now, in some areas, cable television is trying to breach this gap. Would the satellites eventually eliminate the need for cable television?

Dr. MARSTEN. Not in the community service form. The experiments that we are planning now with ATS–F are directed toward a community service type of television, in which the satellite broadcasts to a community ground receiver that in turn feeds what could be an available distribution system.

Mr. DOWNING. Can we look forward to the day when we could have instant communication with any portion of the world?

Dr. MARSTEN. We can, but if you mean instant real-time video communication, you have to qualify it a little. We can get it virtually instantaneously with a combination of cable, broadcast, telephone and so on, but the satellite provides you the instant coverage which you could not get except at greater expense with landlines.

Mr. DOWNING. Very excellent statement. Thank you.

Mr. Karth, Mr. Weicker?

Mr. WEICKER. No questions, Mr. Chairman.

Mr. KARTH. Mr. Symington?

Mr. SYMINGTON. Dr. Marsten, following on Congressman Downing's question, I was speaking earlier with some gentlemen in industry who suggested that in due course there may be no further necessity to make long distance calls, but that all calls would be in a sense local calls.

You have mentioned instantaneous communication throughout the world. Do you foresee a time when, through the use of this technology, we will be able to communicate by telephone anywhere on earth at a given moment?

Dr. MARSTEN. Well, Mr. Symington, there are some aspects of telephone switching technology with which I am not familiar, and any

attempt of mine to predict how they would advance from here would be rather uneducated. Assuming, however, that they might be able to get to the point where they would not be saturated, I think that is a fair projection. I do not know whether it will happen within this century.

Mr. SYMINGTON. You mentioned telephone switching technology is giving you the problem. What is the nature of that problem?

Dr. MARSTEN. Well, I don't know that it is giving us a problem. At present switching technology is a technology with which I am personally not very well acquainted. I am not terribly sure where it is, what the capacities are of the available switching computers that the various telephone people have, or what they might do to accommodate instantaneous worldwide traffic without hangups.

Now, if I could return to the local world of Washington, D.C. and environs, I am sure everyone here has been frustrated by having the switchboard hang up on him when he wants to make, if you will pardon me, a long distance call. This is the sort of problem. And I can't make an educated prediction.

Chairman MILLER. Would the gentleman yield?

Mr. SYMINGTON. Gladly yield.

Chairman MILLER. Isn't it true, and I am not an authority at all, that if someone wants to make a call to St. Louis, his voice may go directly to St. Louis on a wire, part of his conversation. The answer may come back by microwave. If the line is plugged, technically it may go down to St. Louis and then up. His answer may go up to Minneapolis and down, if there is an opening there. That the telephone company uses all of its openings to keep things going, but sometimes these become crowded?

Dr. MARSTEN. I believe that is correct, Mr. Chairman.

Chairman MILLER. And you find yourself a bit frustrated when you want to make a long distance call.

Mr. SYMINGTON. Thank you, Mr. Chairman.

I have one other question, Dr. Marsten. I was very interested in the discussion of the Indian educational television program. It seems to me that we spend a great deal of money and foreign aid to send teams of educators or agronomists to slog through rice paddies to talk to about 50 people in a remote village at great cost. This suggests the possibility of reaching a lot of people with highly useful information, and I trust less cost. I am wondering if you have projected a cost factor for serving these 5,000 receiving stations.

Dr. MARSTEN. I think, Mr. Symington, I should make something very clear about the Indian ITV experiment. The cost for designing, developing, fabricating, debugging, installing, operating, maintaining, providing the program, servicing, and training a ground cadre, for the ground segment, is all on the Government of India.

Mr. SYMINGTON. Right.

Dr. MARSTEN. Now so far as I understand there is no AID money involved in this. What that cost is, we are not exactly sure. Figures between $10 and $15 million have been used, and they still seem to be about right for the experiment, including all of this.

Mr. SYMINGTON. You mean our cost?

Dr. MARSTEN. No, this is the Indian cost.

Now, our cost involves moving one ground station into a position in Western Europe where it can be used for us to maintain control of

ATS–F, once it is positioned to illuminate India, and where we will be able to continue operating the other experiments that are still of interest to us on ATS–F.

The relocation cost, including operation and maintenance of that station for the approximately 1 year of the Indian experiment, will vary from about $1.5 to $1.9 million, depending on exactly where the ground station goes. The only other cost that we have is about $1 million for the 80-watt transmitter and associated portion of the ATS–F integrated transponder and feed system. So the cost to us for the experiment would be between $2.5 and $2.9 million including the spacecraft and transmitter, moving the ground station, installing it in an appropriate spot in Central Europe or Western Europe, operating the satellite and conducting some of the other experiments. Our share is then about $2.5 to $2.9 million in total.

Mr. SYMINGTON. The satellite itself incurs a cost.

Dr. MARSTEN. Oh, yes, Mr. Symington, but the satellite will contain some 18 different experiments. All of them were planned and programed for prior to any agreement to conduct this Indian ITV experiment. We would have run the ATS–F program whether or not there was an Indian ITV experiment, and the planning for the satellites would have taken essentially the same course, because of NASA's firm conviction that the next technology that was needed for the future of satellite communications is technology of large, erectable antenna structures, and the technology of medium level RF power.

Now, those are the things that happen to fit into the Indian ITV experiment framework, but the satellite cost and the program cost would have been there without it. So it is fair, I think, to state that this $2.5 to $2.9 million is the cost to the United States of our share of the Indian ITV experiment.

Mr. SYMINGTON. I would assume we might get some valuable data ourselves from this experiment.

Dr. MARSTEN. Indeed we would. We will get data which shows us how this technology can be used to work with what we call community ground receiving sets. It will tell us whether we are where we think we are with respect to the transmission link design. It will tell us things about the picture quality we can expect to get in community service. It will tell us operating things, about the efficacy of cable distribution from a ground receiver and a space hookup, with country-wide television.

Mr. SYMINGTON. One other question. Do you know what, if any, percentage of the $10 to $15 million that the Indian Government will be allocating to this experiment would be foreign exchange as distinct from rupees? In other words, is there certain hardware that they will have to buy outside of India?

Dr. MARSTEN. Well, Mr. Symington, as I understand the arrangement, we are expecting that the Government of India will use this experiment as a base on which to build an Indian industrial and technological capability. To the extent that they do, I would expect to see their $10 to $15 million expended internally in rupees.

Now, they currently have the capability of producing something like 300 television sets a year. In order to get 5,000 in time for the experiment, they have to increase their technical capability, their production capability, by a rather large factor. And to the extent that they feel

their planning won't let them, there will be foreign exchange, but I don't know what that is yet. They are in the very early stages of planning the details.

Mr. SYMINGTON. Thank you.

Mr. KARTH. Mr. Koch.

Mr. KOCH. No questions.

Mr. KARTH. Mr. Downing has indicated he has another question.

Mr. DOWNING. Yes, thank you.

In Chairman Karth's opening statement, he said "Progress in the utilization of satellite technology, however, has been disappointing in certain respects," and he says "Several Members of Congress have indicated that they believe that the utilization of this modern technology in the improvement of communications overall has lagged far behind its potential."

Do you agree with that statement?

Dr. MARSTEN. Well, Mr. Downing, the utilization of the technology can only go as fast as the technology is here. We have been working in navigation and traffic control with the FAA, for example, the technology is here and we have defined the need and they have asked us for an experiment. So we can advise and we expect them to make the decision. It is their use.

With respect to broadcasts, we are going ahead now as fast as we can, with the ATS–F and G programs, and that is where the technology is. I think it is up to the user agencies to decide how fast they can or will make use of the technology, when it is here. It is not quite here yet for broadcasting, but it is interesting to note that even though ATS–F will not fly until 1972, we have approved a user experiment for ATS–1 with CPB and we have been told by CBS to expect a user experiment from them.

Now, I don't know how to evaluate what is "appropriate rate of speed," but these are signposts that I can offer you.

Mr. DOWNING. Then you disagree with that statement that we are lagging?

Dr. MARSTEN. Well, you can always go faster. I think one can always say it is possible to go faster, but I am not really in a position to say "Yes, this is an optimum rate of speed," or "No, it is not." We could not, for example, establish a community broadcast system right now, if we had the technology. Decisions are still pending on the U.S. domestic system. We don't quite have the technology. ATS–F will fly in 1972.

Mr. DOWNING. All right, thank you.

Mr. KARTH. Mr. Pettis.

Mr. PETTIS. Mr. Chairman, I would like to ask this basic question. To what extent does COMSAT receive any benefit from its unique relationship with the Government, that, say, other commercial organizations, profitmaking organizations in the communications field would not receive? To what extent is COMSAT doing R. & D. and to what extent is NASA supplying them with R. & D. paid for by public funds?

Dr. MARSTEN. Well, Mr. Pettis, the R. & D. done by NASA is available to the entire communications community. For example, in the June 13 meeting we made the results of our technology available to the broadcasters and to educators and to publications people and this was all available in a planned briefing.

COMSAT was there, certainly, because they have an obvious interest. But we took care to invite representatives from all possible interest areas that we could think of.

We make the results of our R. & D. available on an unrestricted basis. COMSAT, as any other user, has access to it.

Mr. PETTIS. But isn't COMSAT the only one authorized to have these satellites up there? So they do have that unique position.

Mr. SHAPLEY. Mr. Pettis, I think the question of who is authorized to have the systems is a matter that would be decided in each case by the FCC, as far as domestic cases are concerned. And, as I am sure other witnesses and agencies directly involved will indicate when they appear before you in these hearings there have been filings for some time before the FCC for the institution of a domestic satellite system.

COMSAT is one of the proposers. ABC and others have filed a variety of proposals. And the decision as to who will be authorized to have satellite systems and what their characteristics will be is one which under the applicable laws and procedures will be made by the FCC.

Dr. MARSTEN. I think we would say one other thing. When we have contractors proposing on new R. & D., and there is a question of what the techniques are, the things that have already been done by NASA are universally available for their use.

Mr. PETTIS. Thank you.

Mr. KARTH. Doctor, the chairman has indicated, and indeed it is true that the jurisdiction of this committee is limited. It may well be that we will get into some areas that this committee has no direct jurisdiction over, and if we do, whatever transpires from that interrogation or from the submission of testimony will be turned over to the appropriate committees in the Congress for their perusal in whatever way they see fit to apply it or to use it. So the major thrust of our interest, I think, will have to be the existing state of the art.

Dr. MARSTEN. Yes.

Mr. KARTH. And the potential or the feasibility of applying that technology; and the level of effort that NASA, as the research and development agency, is undertaking in this field; and the potential payoff from the application of that technology.

Dr. MARSTEN. Yes.

Mr. KARTH. This, I think, is the major thrust of our interest, Mr. Chairman. I hope that I have stated it correctly.

Chairman MILLER. Right.

Mr. KARTH. Now, in answer to one of Mr. Downing's questions, you indicated that the technology probably is not here to use. That is to say, the state of the art has not been sufficiently developed to use this technology.

If that is true, how come we are doing what we are doing, or at least anticipating doing what we are doing in Alaska?

Dr. MARSTEN. Well, what I said was, all the technology for community service isn't here yet. The ATS program has as one of its objectives the proving out of technology. If you don't take into account what is available to you to get some user experience, you may always find that you are a little bit behind in available resources. The experiments that the Alaskans are proposing to conduct with ATS I require fairly large ground stations, not community size.

Mr. KARTH. That is only for broadcasting though. It is not for other types of transmission.

Dr. MARSTEN. I am not sure what the thrust of your question is then.

Mr. KARTH. Well, we are going to apply this technology or at least hopefully, in the opinion of those people who have a responsibility to the State of Alaska, we are going to apply this technology, whatever the state of the art is today?

Dr. MARSTEN. Yes.

Mr. KARTH. I assume that we are in a position, from a state of art standpoint, to go ahead and apply the technology that we have developed up to this point, or are in the process of developing. Isn't that true?

Dr. MARSTEN. Oh, yes. The INTELSAT III and IV technology—well that INTELSAT–III technology, which is here, is something of an advance over the ATS–I technology. Now, part of what we would expect the Alaskans to derive out of the proposed AST–I experiment may lead them to an operational system which could capitalize on INTELSAT–III.

Mr. SHAPLEY. Mr. Chairman, perhaps I could clarify this. There are many aspects in which the technology is fully in hand to move ahead, for example, the domestic satellite systems of many of the sort that have been proposed to the FCC; I think we would regard the technology as well in hand to proceed with those, when an appropriate decision is made.

I think Dr. Marsten's remarks applied primarily to the more advanced areas of broadcast satellites, rather than to the immediate potentialities of communications.

Dr. MARSTEN. That is correct.

Mr. KARTH. That was the thrust of my question. The apparent difference of opinion Mr. Downing felt there existed between Dr. Marsten and myself does not exist.

Dr. MARSTEN. No, it doesn't.

Mr. KARTH. I think Mr. Downing quoted the statement I made in my opening remarks to the effect that:

> Several members of Congress have indicated that they believe that the utilization of this modern technology in the improvement of communications overall has lagged far behind its potential.

You agree with that statement, don't you?

Dr. MARSTEN. Yes. Well, in the domestic system, there are technologies that we have in hand.

Mr. KARTH. I am talking about domestic communications, obviously.

Dr. MARSTEN. All right, fine.

Mr. KARTH. We don't have to talk about international communications. I think we have reached a point where we are utilizing that technology.

Dr. MARSTEN. When we developed the basic technology, Echo, Relay, Syncom, the COMSAT-INTELSAT organization adopted that technology, improved it, and established a transmission system for international point-to-point communication. There has been no action in the United States because filings have not been decided on, as I understand the situation.

Mr. KARTH. That is not under the control or the jurisdiction of NASA, however.

Dr. MARSTEN. No. That is correct.

Mr. KARTH. That is beyond your responsibility.

Dr. MARSTEN. That is right.

Mr. KARTH. Now, what about the level of effort, Doctor? According to your own testimony, we will have spent at the end of the fiscal year some $250 million, I think, in this whole area of communications.

Dr. MARSTEN. Yes.

Mr. KARTH. This is substantially less, for example, than we have spent in most other areas during the last 10 years of this country's involvement in the space effort—planetary and interplanetary probes, lunar exploration, scientific satellites, you name it, we have spent more in almost every one of these areas where the potential payoff is at least questionable in comparison to what the potential payoff will be for applications satellites, in this instance, communications satellites.

Dr. MARSTEN. Yes.

Mr. KARTH. Do you feel our level of effort is really as high as it ought to be—outside of your commitment to support administration budgets, whether these happen to be under Nixon, Johnson, or whomever, I mean, outside of that, do you really feel that our level of effort has been sufficient to do the job that ought to be done and the job we know we can do in the field of space communications?

Dr. MARSTEN. I am frankly not sure at the present time that we could have come a great deal further, over the past 5 or 6 years, than we have come.

Mr. KARTH. What are the unique capabilities of communications satellites as opposed to a terrestrial system?

Dr. MARSTEN. You get instant coverage of great areas. And you get it at a cost which is less than the cost of putting in terrestrial systems.

Mr. KARTH. How much less would you say the cost of a present state of the art satellite communications system would be, as compared to a present state of the art terrestrial system?

Dr. MARSTEN. It will depend on the service and the extent of terrestrial systems already established but it could be anywhere from half to a tenth. I would like to expand my answer for the record.

Precise conclusions can only be reached through careful analysis and, above all, in specific, real situations. The NASA/India joint study addressed a specific situation for a domestic communications system aimed at providing instructional television service to 560,000 rural villages in India.

The study indicated the cost of a satellite system to provide the ITV services, in the absence of a terrestrial infrastructure, to be approximately $233 million plus $8.8 million annual costs. To install a terrestrial system for the same services would cost approximately $394 million plus $26.7 million annual costs.

It should be noted, however, that as the area to be covered or served is reduced, costs for terrestrial systems can be expected to become more competitive. Where there is an existing communications infrastructure, the cost trade-offs become more complex and the services that would be provided by satellites may be more limited in scope. For the case of high density point-to-point trunking serving a densely populated region like the contiguous 48 States, the economics is more likely to favor the terrestrial system.

Mr. KARTH. There would be less cost for equal service?

Dr. MARSTEN. No, no. I didn't mean that. I meant whether the service is point to point.

Mr. KARTH. That is another question. To provide equal service.

Dr. MARSTEN. We are still not talking about the same things, Mr. Chairman. If the service is a point-to-point service, for telephony, for

instance, the cost differential will be one thing. If it is broadcast service, it would be something else.

Mr. KARTH. Well, let's explore each one of them.

Dr. MARSTEN. Well, I would guess, and this is an uneducated guess, that the cost for installing a satellite long-distance telephone system, as compared with ground service, would be about half. And I think that the cost of installing a community, if you will, broadcast service in an area without such a service, as compared with new terrestrial service, would be about an eighth.

Mr. KARTH. Now, going from the development cost to maintenance cost, which, after all, I suppose in the long run is probably even more important than the development cost, since you live with it forever, and since the rate structure pretty much reflects what this everyday cost is, could you give me a comparison in your own judgment as to what the maintenance costs of these two systems would be?

Dr. MARSTEN. No, I couldn't, Mr. Chairman. I am not at all familiar with the operation and maintenance of such systems.

Mr. KARTH. Mr. Shapley, could you?

Mr. SHAPLEY. Not in terms of numbers. I think perhaps that we could prepare and submit for the committee an indication of the factors, the areas of cost, where one is likely to be greater or less than the other, and this might be of use to the committee in developing an understanding of this.

You see, it is a very hypothetical question, you assume you are starting from scratch. One of the interesting things about the Indian experiment is that there they are, in effect, starting from scratch, and so they have assessed the cost there, and they have a completely different picture than we do in this country, where through the long-range communications of the telephone company and others we start with a highly developed system. So the question in the abstract of which would be more costly or what the cost would be in the abstract is a little bit hard to get at, even if you had all the facts at one's fingertips, which we don't at the moment.

Mr. KARTH. We understand that, Mr. Shapley.

Mr. SHAPLEY. I think the significant question here, and the one which I am sure the FCC is wrestling with, is what incremental changes to our total communications systems are in the interests both of the economic picture, as far as competition in the industry is concerned, and in providing the most service for the most people at the least cost. And I believe you will find that this is a matter on which the available data for making the cost comparison would be most completely available at the FCC, rather than in NASA.

Mr. KARTH. Well, you do the best job you can, and we may, within our jurisdiction, even go so far as asking the FCC, if for no other purpose than to turn it over to another committee.

Mr. SHAPLEY. We will.

Mr. KARTH. And you might also, if there is a possibility of NASA doing it, make this kind of a comparative analysis insofar as it relates to the State of Alaska, and what the State of Alaska today wants to accomplish in terms of a new communications system. You may use that, also, as a guide in evaluating the comparative costs of the two systems, if you would, please.

Mr. SHAPLEY. We will do the best we can.

We have not engaged in any studies of cost-effective ways to meet the needs of the State of Alaska for telecommunications services. We understand that the Alaskans are currently developing their requirements, and until these have been carefully analyzed, one can only generalize.

If services are required to meet the total needs of the 2,100 communities in terms of providing telephone, telegraph, TV, and radio programming, satellites would appear to offer an economic benefit over yet-to-be-established terrestrial communications facilities. The principal attribute of satellites is that they can more economically provide services to vast areas. Costs involved in providing services to the many widely separated villages in Alaska would be large, whether provided by terrestrial microwave networks or by satellites. Accurate cost comparisons can only be made when Alaskan requirements are defined in detail.

Mr. KARTH. Mr. Shapley, you were a member of President Johnson's Task Force on Communications Policy, were you not?

Mr. SHAPLEY. Actually, the members of the task force were the heads of the various agencies involved, and at that time Mr. Webb, as Administrator of NASA, was the NASA member on the task force, and I served as his alternate.

Mr. KARTH. Are you familiar with the recommendations made by that task force?

Mr. SHAPLEY. Yes, sir.

Mr. KARTH. Could you give the highlights of those recommendations to this committee for the record at this point?

Mr. SHAPLEY. Well, basically, as I recall, the recommendation of the task group was that in the field of domestic satellite communications the country should move ahead with a domestic satellite system. It proposed an arrangement whereby the COMSAT Corp. would play a leading role in the establishment of such a system, but do this as a trustee on behalf of the other participants. All the decisions on future ownership of the system would be deferred until a later time after what was variously called a pilot or an experimental period had passed.

Mr. KARTH. And what is the status of that recommendation now? Where is it, Mr. Shapley?

Mr. SHAPLEY. My understanding is that, with the other recommendations of the previous administration, these recommendations have been made available to the new administration. The recommendations were made public, and laid before the Congress. And I believe the status is simply as an input available for further decisions to be made by the people responsible.

Mr. KARTH. As a member of that committee, would you provide for the record the total recommendations of that task force, please?

Mr. SHAPLEY. I would be happy to, yes.

The following is a summary of the scope of the report, ground rules, and conclusions and recommendations. The conclusions and recommendations are quoted from the summaries of each chapter in the report. It should be noted that partial dissents to the report were filed by General J. D. O'Connell and Mr. Joseph Bartlett.

CHAPTER I

SCOPE

The study is addressed primarily to the legal and economic structure of the Nation's communications system, and to the policy considerations which, in the Task Force's view, should guide its evolution, both at home and abroad.

GUIDELINES

Four axioms were used to guide the work of the Task Force.

1. There is a National policy that the United States remain a leader among the nations in communications science and technology, and in communications service.
2. Telecommunications policy should seek to maintain and develop an environment always sensitive to consumer needs.
3. Telecommunications should be viewed as a system, extending from public and private research, at one end of the spectrum, to the provision of private and common carrier communications services, at home and abroad, at the other.
4. Special consideration should be given to the needs of the developing nations.

## CHAPTER 2

ORGANIZATION OF THE UNITED STATES INTERNATIONAL COMMUNICATIONS INDUSTRY

I. The Present Organization of the U.S. International Communications Industry is the Product of Long Technological Evolution and Numerous Government Decisions.

II. A Fundamental Re-examination of the Industry is Needed.

A. A Fragmented Ownership Structure Poses a Principal Problem.

B. Other Pressing Problems Concern the Future Roles of COMSAT and the Record Carriers, and Government Regulation and National Policy.

III. Of the Various Alternatives that have been Suggested, Formation of a Single Entity for United States International Transmission seems the most Effective Organizing Principle of the Industry for the Future.

A. Establishing Conditions of Effective Competition Between Cable and Satellite Entities Would be Very Difficult.

B. Economies of Scale Preclude Competing Bimodal Entities.

C. Even Substantial Changes in Today's Regulatory Framework Would Provide Only Limited Benefits Under the Existing Ownership Structure in the Industry.

D. A Single Entity for International Transmission Would Help Rationalize the Industry.

1. It would promote system optimization and enable realization of the available economies of scale.
2. It would further U.S. foreign policy objectives.
3. It would resolve the anomalies of COMSAT's role and function.
4. Formation of a single entity would help resolve the problems of the international record industry.
5. Formation of a single entity could improve the prospects of effective government regulation.

IV. Creation of the Single Entity Should be Subject to Certain Conditions.

A. It Should be Limited to the Provision of Transmission and Other Facilities Where the Economies of Scale are Clearly so Great that Effective Competition is Unlikely.

B. It should not Engage in Manufacturing that can be Provided by the Competitive Marketplace or have any Manufacturing Affiliations.

C. It Should not Provide Domestic Service, save as may be Necessary to Permit Completion of the Pilot Domestic Satellite Program, and Should have no Domestic Carrier Affiliation.

D. It Should be Subject to Strengthened Government Regulation.

V. Restructuring the Industry Will Require Action by Congress.

VI. If the Single Entity Approach is not Implemented, Certain Ameliorative Steps Would Still be Desirable.

## CHAPTER 3

THE FUTURE OF INTELSAT

I. The Success of INTELSAT has Demonstrated the Wisdom of our Commitment to a Global Communication Satellite System.

II. The Definitive Arrangements for INTELSAT Should be Sufficiently Flexible to Adapt to the Changing Needs of Members and to Accommodate Specialized Satellite Facilities Without Weakening the Indispensable Foundations of the Global System.

B. Broad Participation in the Pilot Program is Desirable.

C. COMSAT Should have Primary Responsibility.

D. The Pilot Satellites Should Offer Free Satellite Channels for Non-Commercial and Instructional Television.

E. An Advisory Committee Should be Created to Protect the Interest of All Users.

F. The Pilot Program Should be Consistent wth U.S. International Commitments and Appropriately Related to INTELSAT.

G. The 1934 Communications Act and the 1962 Communications Satellite Act, Read Together, Provide the Legal Basis for Authorization of the Pilot Program as Well as for Governmental Regulation and Supervision.

H. Intensive, High-Level Executive Branch Attention Should be Given to Monitoring the Pilot Program, with One Organization Designated as the Focus.

V. The FCC Should Give Favorable Consideration to a Pilot Domestic Satellite Program Along the Lines Described in this Chapter.

## Chapter 6

### The Domestic Telecommunications Carrier Industry

I. SUMMARY

A. Given the Nature of Public Message Telephone Service, Integrated Control Remains Vital.

B. The Broad Goal of Public Policy Should be to Release and Encourage Potentialities for Innovation in Technology and in Management, Both Within the Public Message Telephone Network and Outside it, Where such Changes do not Affect its Basic Integrity and Viability.

II. New Opportunities are Emerging for Services Supplementing those of the Public Message Telephone Network.

A. Subject to Radio Spectrum Limitations, Liberalized Entry into Inter-City Private Line for-Hire Service Appears Justified.

B. Suppliers of Private Line Services, Both for-Hire and User-Owner, Should be Permitted to Interconnect with Each Other and with Common Carrier Private Line Networks, Subject to Appropriate Standards Regarding Compatibility and Protection.

C. Self-Contained, User-Owner Private Systems and Terminal Equipment Should be Permitted to Interconnect into the Message Telephone Network, Subject to Protection of System Integrity by Development and Publication of System Standards and, Where Necessary, Provision of Protection Equipment.

D. We Agree with the Consensus of Views Presented by the Parties to the Computer Inquiry that Remote-Access Data Processing, or Teleprocessing, does not Presently Exhibit Characteristics Justifying Comprehensive Public Utility Regulation.

E. Subject to Appropriate Technical Standards, Line Brokerage and Sharing by Companies Providing Store-and-Forward Services, as well as Line Sharing by Any Private Line Customer, Should be Permitted.

III. Opportunities for Enlarged Access to the Market for Communications Equipment Should be Explored.

IV. Institutional and Regulatory Changes with Respect to the Operations of Western Union Appear Desirable.

A. In Order to Maintain a Viable Public Message Service, Cost Reductions are Essential. Partial Consolidation of this Service with the Post Office Should be Explored.

B. Western Union's Status as the Supplier of PMS Deserves Further Study.

C. Western Union Should be Permitted to Compete on an Unregulated Basis in Teleprocessing.

D. If Western Union Continues to Provide Public Message Service the Recommendations of the FCC for Consolidating Telex and TWX Appear Sound.

E. Further Study of Western Union's Alternative Futures is Clearly Warranted.

V. Effective Regulation, and Effective Implementation of the Policies Proposed Here, Require Strengthenend Capabilities Both in the FCC and in the Executive Branch.

A. Regulation of the Integrated Common Carrier Communications Network Remains Necessary. It Should be Modernized, Certain Omissions in the Communications Act of 1934 Should be Redressed, and More Stress in Regulatory Policy Should be Placed on Responsive Pricing Practices, Incentives for Cost Reduction, and Reliance on Market Incentives.

A. Growth in Radio Services in the Past Decade has been Remarkable.
B. Spectrum Scarcities are Inhibiting this Growth Under Existing Allocation and Usage Procedures.
C. Growing Demand for Spectrum Use Will Intesify the Problem.
III. President-day Management Approaches and Capabilities are not Adequate to Achieve Optimum Use of the Spectrum.
A. National "Block" Allocation Procedures Lack Adequate Flexibility.
B. Existing Criteria for Apportioning Spectrum Resources Among Competing Uses are Unsatisfactory.
C. The Division of Spectrum Resources and Management Responsibilities Between Government and Nongovernment Uses is a Source of Inefficiency.
D. Spectrum Waste is a Significant Problem.
E. Present Levels of Staff and Funding Devoted to Spectrum Management are Inadequate.
IV. Clear Policy Objectives and a New Approach to Spectrum Management Should be Adopted.
A. A Basic Guideline is Needed for Spectrum Use and Management.
B. Greater Consideration of Economic Factors is Necessary.
C. Greater Attention to Individual Spectrum Uses Should be Achieved Through "Spectrum Engineering" and Related Technical Considerations.
V. The Above Findings Highlight the Need for Action in Selected Problem Areas.
A. Land Mobile Radio Services.
B. Public Safety Radio Services.
C. Television Broadcasting.
D. Microwave Services (1000–10,000 MHz).
E. Millimeter Wave Services (Above 10,000 MHz).
F. Scientific Uses.
VI. Enhanced Management Capabilities and a Restructuring of Responsibility and Authority are Required.

## Chapter 9

### The Roles of the Federal Government in Telecommunications

I. Traditionally, Government has Viewed Telecommunications Primarily as a Mission-Support Function, Rather than a Focus for Public Policy. The Result has been that Policy has Evolved as a Patchwork of Limited, Largely *Ad Hoc* Responses to Specific Issues, Rather than a Cohesive Framework for Planning. Government Organization for the Formulation and Implementation of Communications Policies Reflect this Evolution.
A. The Framework Established by the Communications Act of 1934, Although Combining the Broadcasting and Common Carrier Regulatory Functions, Remains Limited in Scope.
II. The Patchwork Nature of the Present Structure is not Conducive to Optimum Performance of the Telecommunications Activities and Requirements of the Federal Government.
A. Existing Organizational Arrangements Make Effective Spectrum Management Difficult.
B. The Absence of a Central Focus Possessing the Requisite Technological and Economic Skills Makes More Difficult the Development of a Sound and Forward-Looking International Telecommunications Policy.
C. Government Research and Development and Procurement Efforts are not Organized to Ensure that Social Benefits Inherent in Telecommunications Technology are Promptly Realized.
D. The Absence of a Central Focus for Advice and Assistance to States and Localities has Resulted in Wasteful Duplication and Unmet Needs in Programs Utilizing Federal Funds.
E. The Policy Coordination Necessitated by the Plethora of Government Telecommunications Roles is Inadequately Performed by a Multiplicity of Committees.
F. Recent Events have Underscored the Lack of an Effective Government Capability for Long-Range Telecommunications Policy Planning.
III. Steps Must be Taken to Improve Government Performance in Common Carrier Regulation and Broadcast Licensing.
A. Steps Must be Taken to Strengthen FCC Capabilities in These Areas.
B. Greater Multi-Disciplinary Capabilities Within the Executive Branch are Required to Forecast Demand and Technology and to Provide a Frame-Work for the Operation of Prototype Experiments.

IV. A New Government Telecommunications Capability is Urgently Required.
A. To Meet the Needs Described Above Requires the Creation of a New Government Capability Embodying a Variety of Both Missions and Personnel.
B. The Executive Branch Would be Able to Make Valuable Contributions to Regulatory Decisions.
C. A Framework Would be Provided for More Effective Spectrum Management.
D. Telecommunications Research and Development, Especially that Associated with Prototype Experiments, Would be Significantly Strengthened.
E. Significant Opportunities Would be Presented, Especially in Connection with Procurement, for the Realization of the Benefits of New Technology.
F. On-going Mission-Support Telecommunications Activities Would not be Supplanted.
G. Required New Programs to Meet the Pressing Need for Policy-Trained Personnel in the Telecommunications Field World be Enhanced.
H. The Proposed Capability and the Communications Policy Training Programs Would Provide the Prerequisites for the Formulation and Implementation of Coherent and Comprehensive Telecommunications Policy.

Mr. KARTH. Has President Nixon appointed a similar task force or study group to make an evaluation and followup that evaluation with recommendations similar to the President Johnson task force?

Mr. SHAPLEY. To my knowledge, there is no task force with the same scope, covering the entirety of the range of communications problems. As you will recall, the charter of President Johnson's task force was a very all-inclusive charter, and it covered many, many subjects, many of them not related at all to the subject of communications satellites. I know of no similar group in the new administration.

Mr. KARTH. Dr. Marsten, on page 13 you said "Two contractual studies on telephone broadcast satellites were recently completed. These examined the full range of technical possibilities, problem areas, and cost factors involved in transmitting both monochrome and color television program material."

Where are the results of those studies which were just completed?

Dr. MARSTEN. Mr. Chairman, "the full range of" was changed to "some of the technical possibilities."

Mr. KARTH. I beg your pardon?

Dr. MARSTEN. A typographical error in the printed statement. In the second line, "These examined some of the technical possibilities." We changed that. It wasn't a full range, because they couldn't be exhaustive studies.

Mr. KARTH. I am not interested in semantics. If you could just give me the results of the studies, whatever they were full or partial. I feel the committee might be benefited by it.

Dr. MARSTEN. The technical possibilities of transmitting monochrome and color television to relatively inexpensive community and institutional service are very good. The ATS–F program, we expect, will prove out that technology at UHF. We think that the cost factors will end up being primarily determined by coverage areas. The technology that we will prove out, at UHF, on the ATS–F satellite could give you coverage of roughly one-third of the country in a single beam. What you have to do, if you are going to provide this kind of service in a domestic system, is get coverage of the entire country.

The cost to do that is primarily the cost of a national-coverage satellite antenna system, and the technical limitations which that imposes will determine the cost of the ground stations. I cannot give you figures, because the service needs will determine the technology, which will dictate the costs.

The technology that we need, that we don't yet have for this, is the development of high-powered tubes. We are conducting exploratory research and development to get that technology now. The technical prospects for transmitting to slightly augmented home television sets are substantially less good. Studies that we have conducted and studies that were conducted by the National Academy of Sciences have come up with essentially the same results, namely, that the development of high-powered tubes for that sort of service is a technology that we don't see for at least another 10 to 12 years.

Mr. KARTH. Is that at our present level of effort, or is that at some advanced level of effort that you foresee in the future?

Dr. MARSTEN. It has nothing to do with the level of effort. It is just the pace at which one can develop that power level.

Mr. KARTH. It is the nature of the beast, in other words.

Dr. MARSTEN. Yes, sir. One talks about power levels of 15 kilowatts in a single tube, in a spacecraft. We are currently at 80 watts and that would have to be increased by a factor of nearly 200. So the power just has to be reached in steps and that is about how long we think it will take.

Mr. KARTH. I want you to provide for the record the results of these two contractual studies just completed.

Dr. MARSTEN. We will be happy to, Mr. Chairman.

Mr. KARTH. And also, if you would, provide in addition to that areas where the studies indicate that some additional research is required, the extent of the research required in your judgment, and what the cost of that research and development program would be.

Dr. MARSTEN. Fine, will do.

Three principal, conceptual designs resulted from the studies. They are characterized as shown in the table below.

| Type of service | Direct broadcast | Community | Community |
|---|---|---|---|
| Frequency | UHF | 2.5GHz | 12GHz. |
| Number of TV channels | 1 | 7 | 6. |
| Coverage, square miles | 1,000 000 | 2,200,000 | 2,200,000. |
| Weight, pounds | 3,500 | 1,600 | 1,600. |
| Spacecraft power, kilowatts | 12 | 4 | 2.5. |
| Booster | Titan III-C | Atlas-Centaur | Atlas-Centaur. |

The direct broadcast satellite would not be technically feasible until the mid-1980's. If the required technology is pursued, the others would be technically feasible to launch by the late 1970's.

Principal technologies requiring additional reasearch are: multi-kilowatt RF power tubes and associated high power components for TV transmission, thermal control subsystems, high power feeds, low-sidelobe multiple-beam antennas and beam shaping, and solutions to high voltage breakdown and efficient heat dissipation systems. For direct broadcast application to unaugmented conventional TV sets, RF output powers up to 15 kilowatts are required. Long-term research programs would be needed to develop such a capability. For community reception for group viewing or distribution via cables or lowpower transmission to homes and classrooms, the technlogy is near to hand. Research is required to develop efficient RF output tubes for this purpose at power levels of the order of 0.5 to 2 kilowatts. The cost for advancing the technology for community reception is considerably less than for direct or individual reception. $2–5 million would be needed for the lower-power tubes, and several times more is estimated to develop the multi-kilowatt tubes:

Mr. KARTH. On page 16, at the top of the page you said:

We have also participated extensively in various ad hoc intragovernmental working groups concerned with communications satellite policy and technology, with particular emphasis on domestic satellite possibilities.

I wonder if you could provide for the record a rather comprehensive report, a summary, on these ad hoc intergovernmental working groups, and the results of your efforts there; whether you have come to any conclusions, things of that character, which might be helpful to the committee.

Dr. MARSTEN. Fine.

INTRAGOVERNMENTAL WORKING GROUPS CONCERNED WITH COMMUNICATIONS SATELLITE POLICY AND TECHNOLOGY

1. THE PRESIDENT'S TASK FORCE ON COMMUNICATIONS POLICY

President Johnson appointed this Task Force in August 1967 to make a comprehensive study of communications policy with emphasis on frequency management, domestic satellites and U.S. international carriers. Fifteen agencies of the Federal government, including NASA, participated in this study. A summary of the Report, submitted to President Johnson in December 1968, was provided to you in response to your question concerning the final report of the Task Force.

2. TECHNICAL COMMITTEE ON COMMUNICATIONS SATELLITES

This committee was established in 1961 and is still in operation. It serves as a means to exchange information on satellite communication technology problem areas and plans between the Department of Defense and NASA. NASA provides the secretariat for the group.

3. COMMUNICATIONS SATELLITE SUBPANEL OF THE UNMANNED SPACECRAFT PANEL

The purpose of this panel is to coordinate NASA and DOD communications satellite programs. NASA is serving as co-chairman of the panel.

4. US CCIR NATIONAL COMMITTEE AND INTERNATIONAL TELECOMMUNICATIONS UNION STUDY GROUPS

Working through the State Department, NASA has participated on the US study groups for many years and this past September provided significant inputs to an International Interim Meeting of the CCIR Study Groups IV on space systems. This meeting was held in Geneva in preparation for a January 1970 Plenary meeting of the CCIR (International Radio Consultative Committee) in New Delhi and a 1971 World Administrative Radio Conference on space systems. In attendance were nearly 550 representatives of 80 different member nations and private operating companies. Of 130 technical documents prepared for the meeting 62 were prepared by the US Study Groups with NASA making contributions to many of them. NASA was represented on the US delegation to the Geneva meeting and held several official positions at the conference. Eight of the 35 US delegates were from NASA; the others were from the Office of Telecommunications Management, FCC, FAA, DOT, DOC, and private organizations. The papers dealt with technical characteristics of communication satellite systems; sharing problems for communications satellite services; problems related to the efficient use of the geostationary orbit; technical characteristics of space research systems and of space-to-space communications links; and communications and radio determination satellite services for aircraft and ships.

5. UNITED NATIONS DIRECT BROADCAST SATELLITE WORKING GROUP

NASA personnel working with the State Department made contributions to the United Nations Direct Broadcast Satellite Working Group. Of particular significance was a NASA paper on the technological and economic aspects of direct broadcast satellites.

6. BIOMEDICAL COMMUNICATIONS NETWORK

NASA and HEW/National Library of Medicine personnel have been exploring the requirements for a biomedical communications network for professional specialized information interchange, and the extent to which communications satellites can contribute to its needs.

7. JOINT NAVIGATION SATELLITE COMMITTEE

This committee reviewed the technical and economic potential of satellites to meet needs for improved aid and sea navigation, traffic control, search and rescue, and related functions. Members consisted of FAA, DOD, DOI, DOC, the Treasury Department and NASA. The final report of this Committee in 1966 concluded that satellites are attractive for aircraft and ship communications, that satellite technology appeared possible for aircraft separation, and that space technology and economic considerations were sufficiently promising to warrant continued R&D.

8. JOINT NASA/FAA AIR TRAFFIC CONTROL SATELLITE WORKING GROUP

The purpose of this group is to examine what is required for a pre-operational UHF aeronautical satellite system for a one-ocean capability in communications and surveillance. Results should be forthcoming in 1970.

9. JOINT NASA/ESRO/FAA TRAFFIC CONTROL WORKING GROUP

The function of this group is to determine if a basis exists for a cooperative satellite experiment project in traffic control via satellites with the European Space Research Organization (ESRO). Thus far, a preliminary agreement has been reached on a mission specification, and a satellite system definition is in preparation.

10. AD HOC INTRAGOVERNMENTAL COMMUNICATION SATELLITE POLICY COORDINATION COMMITTEE

This committee, chaired by the Director of Telecommunications Management, was established in February 1966 and included representatives from OTM, AID, FAA, State, GSA, NASA, DOD, USIA, and FCC, but became inactive with the establishment of the President's Task Force referred to previously. Panels of this committee have dealt with various questions on and ad hoc basis, one of which is presently considering US policy with regard to International Satellite Broadcasting.

Mr. KARTH. On page 18 and 19, you talk about Governor Miller and the proposal that Alaska has made and so on. And you mentioned two different dates when meetings had been held in Alaska. It seems to me that someone suggested that there was another recent meeting following both of those dates you have mentioned held in Alaska on this subject, late last week. Was there a NASA representative at that meeting?

Dr. MARSTEN. So far as I know, no, Mr. Chairman.

Mr. KARTH. I see.

Dr. MARSTEN. We were not informed of that meeting, Mr. Chairman.

Mr. KARTH. I see. Are you aware of anyone who might oppose the proposal that the State of Alaska has made and is now under consideration?

Dr. MARSTEN. I am not.

Mr. KARTH. On the bottom of page 23, you say:

In summary, NASA is participating at modest cost in a very substantial and significant cooperative communications experiment.

I wonder if you would furnish for the record the extent of that cost?

Dr. MARSTEN. Yes, Mr. Chairman.

(The information referred to follows:)

The total ATS-F estimated cost peculiar to the India ITV experiment is $2.5 to $2.9 million. This amount is composed of $1.5 to $1.9 million to move the ground station to Europe and operate for one year. The cost range is dependent on the location in Europe. In addition, the cost of the UHF transmitter and associated portion of the ATS-F integrated transponder and feed system is about $1 million.

Mr. KARTH. Certainly NASA does not have the responsibility for promoting air traffic control and navigation systems. Who in the Government has that responsibility, in your judgment, Doctor?

Dr. MARSTEN. That is the FAA's responsibility, as we see it.

Mr. KARTH. In both instances?

Dr. MARSTEN. Navigation and air traffic control.

Mr. KARTH. Yes.

Dr. MARSTEN. Air navigation, yes. Not maritime navigation.

Mr. KARTH. I understand. Have the agencies with whom you are working, FAA and DOT, FCC, I suppose, have they indicated satisfaction with the way NASA is proceeding?

Are they satisfied with your progress?

Dr. MARSTEN. I think so. There was no dissatisfaction expressed as a result of their participation in the last set of exploratory talks with ESRO. They are helping us define the technical requirements for a one-ocean experiment in satellite air traffic control. And I have not heard any statement from them that we are not proceeding fast enough.

Mr. KARTH. Do they concur with the technical characteristics of NASA's experimental systems?

Dr. MARSTEN. We don't have systems yet, Mr. Chairman. We are defining the requirements for an experiment, and whatever systems we do design will be responsive to those requirements.

Now, the requirements so far as the service, the precision of position fixing and so on are agreed jointly by NASA and the FAA.

Mr. KARTH. Are there other questions?

Mr. SYMINGTON. I just have one question.

Mr. KARTH. Mr. Symington.

Mr. SYMINGTON. In response to the chairman's question on the level of resources invested in the communications program, and whether or not you thought it had been enough to do the job, I believe you said you weren't sure that you could have come much further in the last 5 years. And I am intrigued by that, because of course what we could have done in the last 5 years is really predicated upon what we might have done in the preceding 5 years, at the time when we decided to go to the moon.

Dr. MARSTEN. That is correct.

Mr. SYMINGTON. And since that time we have gone to the moon at a cost of about $25 billion. Whereas, if we had spent $250 million on communications during that period, that's just 1 percent of what we spent on Apollo. So when you say you are not sure we could have come much further, are you really saying that with an investment of that proportion, into a program such as this, which could have alerted Camille victims and this sort of thing before the event, we couldn't have done a bit better?

Mr. SHAPLEY. I was going to say, Mr. Symington, it is a little bit hard to know where hindsight ends and foresight begins, and I think that as a general rule, undoubtedly we could always do more; we could have done things a year ago that we now see are important this year.

Looking at the history of NASA. I believe that especially since—well, from the start, but especially since the applications technology series of satellites was begun—the agency, and with the help of this committee, has given really very good support to the communications areas, to the next steps as seen. If the rules of the game were changed

and we were now spending $250 million a year, instead of the amount that we have been spending, I am sure a program of a different character and with a faster pace and so on could have been devised.

But I believe that—and my colleagues can correct me if they don't agree—by and large we have been taking each of the technical steps in the proper series, at a reasonable pace over the past years. And I think—and this perhaps goes to one of the subjects of concern to the committee—that we have to realize that in communications, as in other space applications, what we know, what we learn and develop based on what can be done and how it can be done in space has to be kept in balance with the capacity of the rest of the community to accept the results into the system.

I don't want to leave the impression, by saying that the technology is ready for domestic satellite systems, that we are pointing the finger at anybody else for holding things up, for causing any delays. There are very real and very complex problem areas in which we have no particular competence, which are very real problems in the introduction of technology into something as all-pervasive in our whole economic system as communications.

So this is what our recent efforts that we have described have been, to push a little bit, if you please, the potential users in communications. This is an effort on our part to help this end of the process along, so that it will keep pace and be able to utilize more fully and more promptly the technology as it proceeds.

Mr. SYMINGTON. Well it interests me that you have answered that you feel that we have proceeded in an orderly fashion, building on what we have learned, and moving ahead to the next step.

Mr. SHAPLEY. Yes.

Mr. SYMINGTON. Now the ultimate goal here is listed by Dr. Marsten in some of the objectives of the communications program. The ultimate goal of the moon program was landing men on the moon. Are we suggesting that the communications goals are less visible, and therefore, we are proceeding in an orderly fashion at 1 percent of the investment that we put into the Apollo program?

Perhaps I should simply ask Dr. Marsten what did you mean, sir, when you said that we could not have come much further in the communications program in the last 5 years than we have come?

Dr. MARSTEN. I meant that building on where we had been, I thought that we had come about as far as we could for the investment.

Mr. SYMINGTON. Right.

Mr. JAFFE. If I might help just a little bit, Mr. Chairman.

Mr. KARTH. Mr. Jaffe.

Mr. JAFFE. There are some pieces of technology that although one can say we might proceed a little more rapidly if we had unlimited funds, are still rather illusive. High power in space is still that kind of thing. The nuclear reactor, as part of a space power system, is still somewhere in the future, and that's the kind of order of magnitude step in power that is required for some of these systems like the broadcast systems that Dr. Marsten talked to.

So those, the advent of a development of a broadcast satellite system, must come along concurrently with that kind of technological development. And that is still in the future. So although we can spend more resources in some areas, there are some things that you can't move along because you need the corresponding technology.

Mr. SYMINGTON. I think you will have to help us explain this at times to our constituents, who would not find it easy to understand why it is easier to go to the moon, land men and return them safely, than it is to talk to one another on earth, using the same scientific skills.

Mr. KARTH. I think if the gentleman from Missouri would permit me, and I say this without any malicious intent whatsoever, I think had the Apollo people been as conservative as the applications people in NASA, we may not have gotten to the moon. It seems to me we might not have gotten there during the next decade. I sincerely believe that. And this is not in any sense an indictment of those who are charged with the responsibility of "achieving these technological breakthroughs in an orderly fashion."

It just seems to me that the magnitude of the technology probably is not as great, does not involve all of the unknowns, and the advancements that had to be made in many different areas of technology as were required for the lunar landing. While we will allow your answer to my question to remain in the record, because after all it expresses your judgment, I doubt very seriously that this technology could not be speeded up manyfold, if we had, in fact, expended considerably greater amounts of money than we have in the communications area.

We know that we can speed up technological development. This has been proven time and time and time again. Whenever the country has put its mind to it, it has been done. We have the resources, I think, and we have the skilled manpower. We have the academic community, if we need to call on it, to assist us. There is no reason why it can't be done. I think finances really are probably more important, and more of a roadblock to the so-called orderly process that we on these occasions have chosen to follow.

I will make that statement for the record.

Mr. SHAPLEY. Mr. Chairman, I don't believe I disagree with your statement at all. I would like to comment that if the national decision-making process were to come up with a decision that we should try to get a broadcast satellite, for example, of such and such a characteristic in orbit over Kansas City or wherever, by such and such a date, a decision which was as clearcut as the lunar landing decision, then I am sure that we could focus and harness the research and development and test program toward that end.

In the applications area, we are not working within the framework of such a clearcut decision. We are sort of developing the technology with one hand, and then assessing what its possible uses and adoption will be at the same time. So you have a somewhat different situation as far as being able to focus your technological efforts.

Mr. KARTH. There is no disagreement between the gentleman from Missouri and the gentleman from Minnesota and you on that particular point. Where the disagreement lies, I think, is that NASA, in the area of applications, has not been nearly as aggressive as they ought to be in trying to influence the judgment of the powers that be that we ought to take a new look at this technological potential, and expand our efforts considerably, perhaps manyfold. I don't know of any program where an agency of government has had as much assistance and as much encouragement as NASA has had from this committee and from the Congress generally as the Space Applications Program. I know of none, other than the Apollo program in its initial

stages, when the country got behind it as the major national objective.

You have had a lot of encouragement of Space Applications from this Congress, particularly from this committee, and I am just wondering why NASA doesn't become a bit more aggressive about it. Are there further questions?

Mr. SYMINGTON. No, thank you.

Mr. KARTH. Thank you very much.

The next witness is Mr. Plummer, Acting Director of Telecommunications Management, Office of Emergency Preparedness, Executive Office of the President.

Mr. Plummer, would you come to the witness table, please.

Mr. Plummer, we are very pleased that you would come to the committee hearing this morning, and we ask you to present your statement at this time.

Please proceed, sir.

## STATEMENT OF WILLIAM E. PLUMMER, ACTING DIRECTOR, OFFICE OF TELECOMMUNICATIONS MANAGEMENT, EXECUTIVE OFFICE OF THE PRESIDENT

Mr. PLUMMER. Thank you very much. Inasmuch as I have been acting only since the first of October, I brought along some of the staff to help me in areas where I am not familiar with the details. Mr. Ralph E. Clark, International Telecommunications; Mr. Richard G. Gould, Advanced Technology; Mr. David B. Hall, National Telecommunications; Mr. Charles E. Lathey, Emergency Preparedness; and Colonel Ward T. Olsson, Communications Satellites.

Mr. KARTH. Thank you, sir.

Mr. PLUMMER. Mr. Chairman and members of the committee:

At the outset, I would like to enter into the record that, for the past 3 months, I have been an Acting Assistant Director of the Office of Emergency Preparedness and, in addition, the Acting Director of Telecommunications Management.

I am confident that the chairman and the members of this committee are fully aware of the organization and functions of my office, hence I do not intend to take up your time in describing the office. I have, however, brought with me a current charter which includes the Executive orders by which this office was established and certain authority and responsibilities assigned to it. With your permission I will submit it for the record.

Mr. KARTH. Without objection, so ordered.

(The document referred to is as follows:)


OFFICE OF
TELECOMMUNICATIONS
MANAGEMENT

# CHARTER

## of the
## DIRECTOR OF
## TELECOMMUNICATIONS MANAGEMENT

## SPECIAL ASSISTANT TO THE PRESIDENT
## FOR TELECOMMUNICATIONS

## ASSISTANT DIRECTOR,
## OFFICE OF EMERGENCY PREPAREDNESS

## FOREWORD

This pamphlet contains information pertaining to the responsibilities, authority, office organization, and functional interrelationships of the Director of Telecommunications Management/Special Assistant to the President for Telecommunications/Assistant Director, Office of Emergency Preparedness.

## INTRODUCTION

On February 16, 1962, by Executive Order 10995, the President of the United States established the position of Director of Telecommunications Management in the Executive Office of the President, which position is held by one of the Assistant Directors in the Office of Emergency Preparedness.

On August 21, 1963, the President stated that the Director of Telecommunications Management shall also serve in the capacity of Special Assistant to the President for Telecommunications.

All three of the foregoing positions are held by a single individual who derives his authority and responsibilities from the following:

- Subsections 606(a), (c), and (d) of the Communications Act of 1934, as amended, and as delegated by the President through the Director of the Office of Emergency Preparedness.

- The Communications Satellite Act of 1962, P.L. 87-624, 87th Congress, H.R. 11040, August 31, 1962.

- Executive Order 10705, "Delegating Certain Authority of the President Relating to Radio Stations and Communications."

- Executive Order 10995, "Assigning Telecommunications Management Functions."

- Executive Order 11051, "Providing Responsibilities of the Office of Emergency Preparedness in the Executive Office of the President."

- Executive Order 11084, "Amending Executive Order No. 10995, Relating to Telecommunications."

- Executive Order 11191, "Providing for the Carrying out of Certain Provisions of the Communications Satellite Act of 1962."

- The President's Memorandum of August 21, 1963, subject: "Establishment of the National Communications System."

- Office of Emergency Preparedness Order 1100.1B, "Organization and Functions Manual."

In order to provide an understanding of the responsibilities and authority of the Director of Telecommunications Management/Special Assistant to the President for Telecommunications/Assistant Director, Office of Emergency Preparedness, the following are contained in this pamphlet:

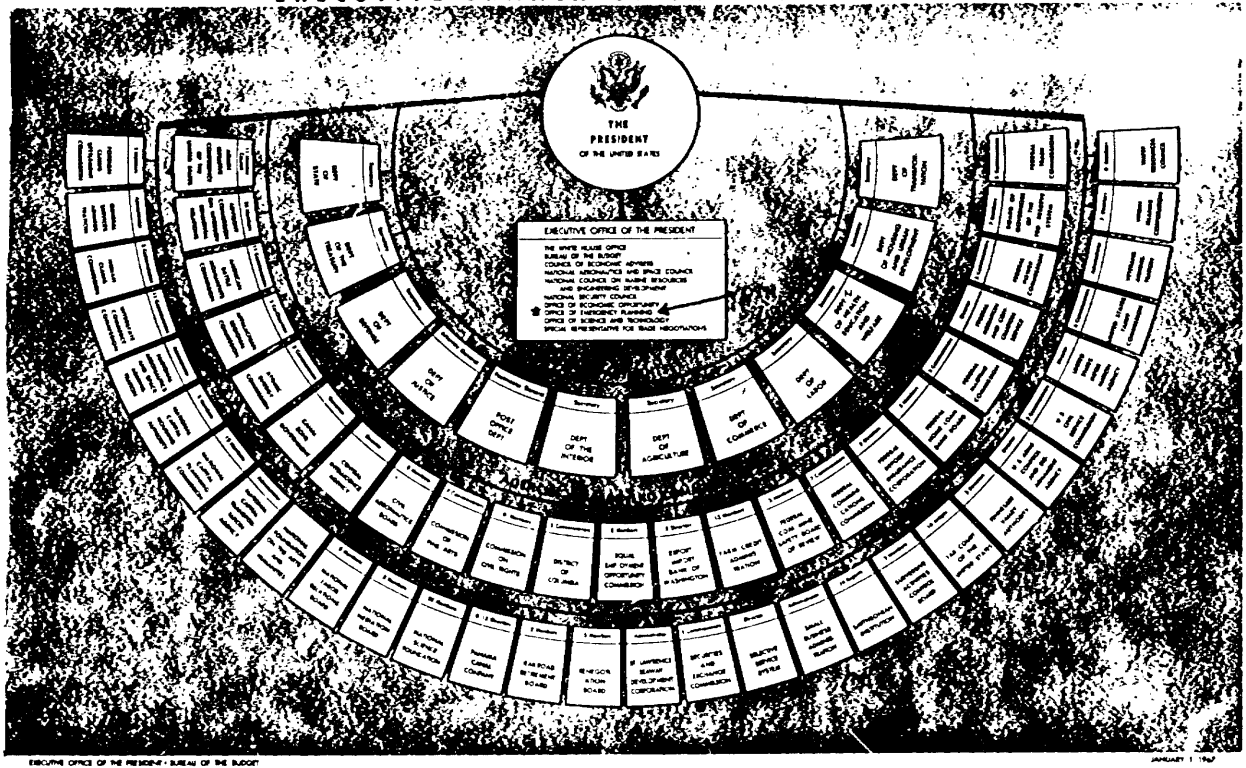
- Organizational chart of the Executive Branch of Government, Chart 1.

- Assignment of Telecommunications Responsibilities, Chart 2.

- Functional Organization of the Office of the Director of Telecommunications Management, Chart 3.

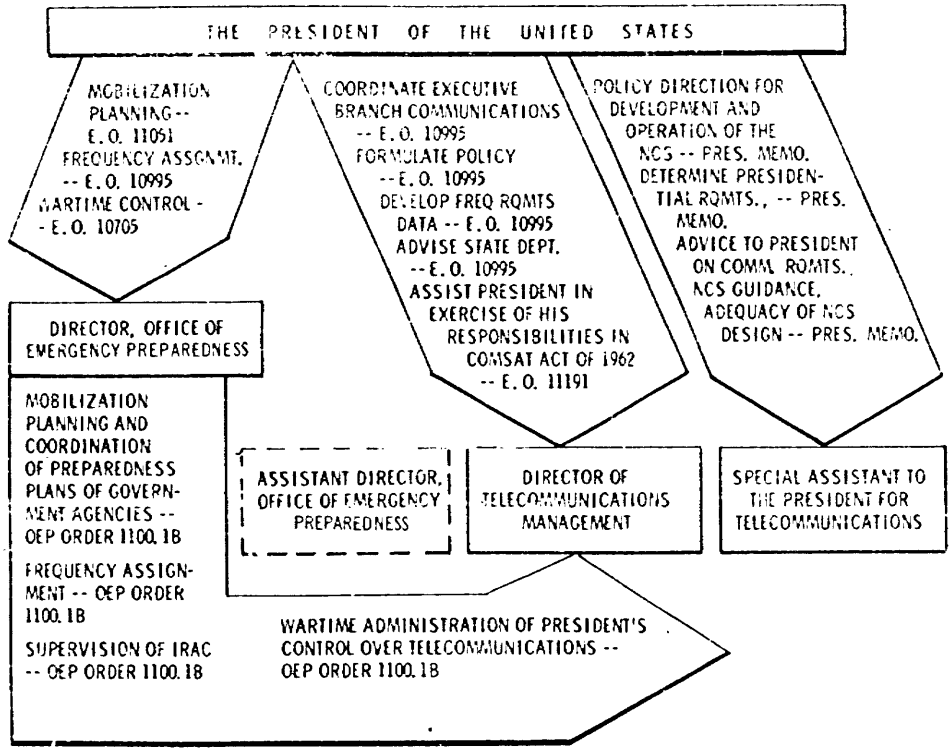
- The Office Charter.

# EXECUTIVE BRANCH OF THE GOVERNMENT

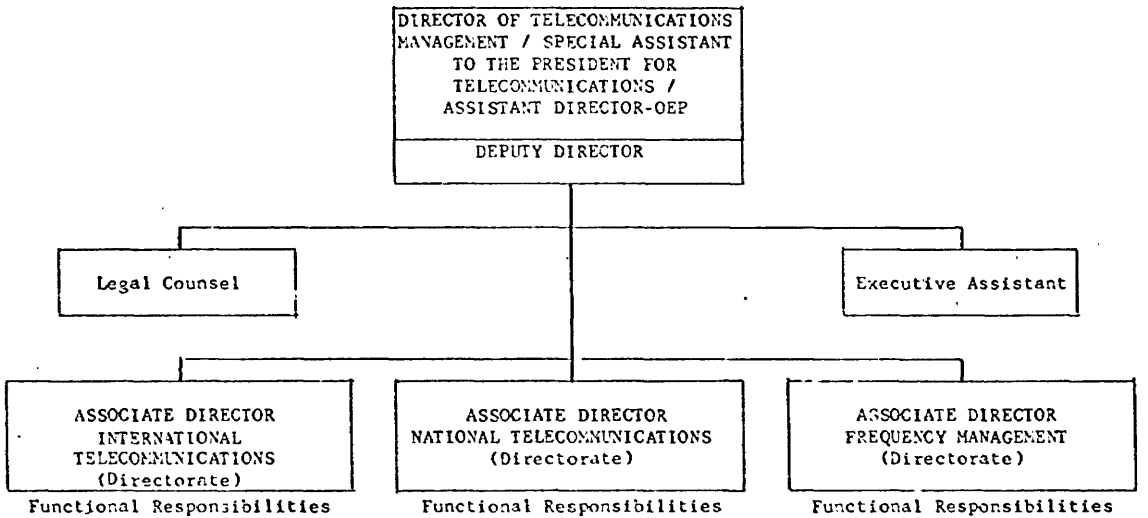



*Name changed to Office of Emergency Preparedness by P.L. 90-608 dated October 21, 1968.

# RESPONSIBILITY AND ASSIGNMENTS



EXECUTIVE OFFICE OF THE PRESIDENT
OFFICE OF EMERGENCY PREPAREDNESS



# CHARTER OF THE DIRECTOR OF TELECOMMUNICATIONS MANAGEMENT/ SPECIAL ASSISTANT TO THE PRESIDENT FOR TELECOMMUNICATIONS/ ASSISTANT DIRECTOR, OFFICE OF EMERGENCY PREPAREDNESS

## PREAMBLE*

WHEREAS telecommunications is vital to the security and welfare of this Nation and to the conduct of its foreign affairs;

WHEREAS it is imperative that the United States maintain an efficient and well-planned national and international telecommunications program capable of stimulating and incorporating rapid technological advances being made in the field of telecommunications;

WHEREAS the radio spectrum is a critical natural resource which requires effective, efficient and prudent administration in the national interest;

WHEREAS it is essential that responsibility be clearly assigned within the executive branch of the Government for promoting and encouraging effective and efficient administration and development of United States national and international telecommunications and for effecting the prudent use of the radio frequency spectrum by the executive branch of the Government;

WHEREAS there is an immediate and urgent need for an examination of ways and means of improving the administration and utilization of the radio spectrum as a whole;

*Executive Order 10995

WHEREAS there is an immediate and urgent need for integrated short and long-range planning with respect to national and international telecommunications programs, for continuing supervision over the use of the radio frequency spectrum by the executive branch of the Government and for the development of national policies in the field of telecommunications;

NOW, THEREFORE, as President of the United States and Commander-in-Chief of the armed forces of the United States, and by virtue of the authority vested in me by sections 305 and 606 of the Communications Act of 1934, as amended (47 U.S.C. 305 and 606), and by section 301 of Title 3 of the United States Code, it is hereby ordered as follows:

DIRECTOR OF TELECOMMUNICATIONS MANAGEMENT
POSITION ESTABLISHED*

SEC. 1. There is hereby established the position of Director of Telecommunications Management, which position shall be held by one of the Assistant Directors of the Office of Emergency Preparedness provided for under Reorganization Plan No. 1 of 1958, as amended (72 Stat. 1799).

NATIONAL COMMUNICATIONS
OBJECTIVES*

SEC. 6. In carrying out functions under this order, the Director of Telecommunications Management shall consider the following objectives:

a. Full and efficient employment of telecommunications resources in carrying out national policies;

*Executive Order 10995

b. Development of telecommunications plans, policies, and programs under which full advantage of technological development will accrue to the Nation and the users of telecommunications; and which will satisfactorily serve the national security; sustain and contribute to the full development of world trade and commerce; strengthen the position and serve the best interests of the United States in negotiations with foreign nations; and permit maximum use of resources through better frequency management;

c. Utilization of the radio spectrum by the Federal Government in a manner which permits and encourages the most beneficial use thereof in the public interest;

d. Implementation of the national policy of development and effective use of space satellites for international telecommunications services.

TELECOMMUNICATIONS RESPONSIBILITIES*

SEC. 2. Subject to the authority and control of the President, the Director of Telecommunications Management shall:

a. Coordinate telecommunications activities of the executive branch of the Government and be responsible for the formulation, after consultation with appropriate agencies, of overall policies and standards therefor. He shall promote and encourage the adoption of uniform policies and standards by agencies authorized to operate telecommunications systems. Agencies shall consult with the Director of Telecommunications Management in the development of policies and standards for the conduct of their telecommunications activities within the overall policies of the executive branch.

*Executive Order 10995

b. Develop data with regard to United States Government frequency requirements.

c. Encourage such research and development activities as he shall deem necessary and desirable for the attainment of the objectives set forth.

d. Contract for studies and reports related to any aspect of his responsibilities.

FREQUENCY MANAGEMENT RESPONSIBILITIES*

"SEC. 3.

a. The authority to assign radio frequencies to Government agencies, vested in the President by subsection 305(a) of the Communications Act of 1934, as amended (47 U.S.C. 305(a)), including all functions heretofore vested in the Interdepartment Radio Advisory Committee, is hereby delegated to the Director of the Office of Emergency Preparedness, who may redelegate such authority to the Director of Telecommunications Management. Such authority shall include the power to amend, modify, or revoke frequency assignments.

b. The authority to authorize a foreign-government to construct and operate a radio station at the seat of government vested in the President by subsection 305(d) of the Communications Act of 1934, as amended (47 U.S.C. 305(d)), is hereby delegated to the Director of the Office of Emergency Preparedness, who may redelegate such authority to the Director of Telecommunications Management. Authorization for the construction and operation of a radio station pursuant to this subsection and the assignment of a frequency for its use shall be made only upon recommendation of the Secretary of State and after consultation with the Attorney General and the Chairman of the Federal Communications Commission."

*Executive Order 10995, as redelegated.

MOBILIZATION RESPONSIBILITIES*

Coordinate the development of plans and programs for the mobilization and use of telecommunication resources in an emergency; provide telecommunications policy guidance to other agencies in preparedness planning; plan to administer the use of the national telecommunication resource in a war emergency; and, upon proclamation that the United States is engaged in a war, administer the use of the telecommunication resource.

ASSISTANT DIRECTOR, OEP, RESPONSIBILITIES*

Serve as advisor to the Director on policy matters. Represent the Director in dealings with policy level officials of Federal departments and agencies and with nongovernmental groups. Assume responsibility when assigned by the Director, OEP, for special programs which may involve various segments of OEP.

WARTIME RESPONSIBILITIES**

SEC. 606.

a. During the continuance of a war in which the United States is engaged, the President is authorized, if he finds it necessary for the national defense and security, to direct that such communications as in his judgment may be essential to the national defense and security shall have preference or priority with any carrier subject to this Act. He may give these directions at and for such times as he may determine, and may modify, change, suspend, or annul them and for any such purpose he is hereby authorized to issue orders directly, or through such person or persons as he designates for the purpose, or through the Commission. Any carrier

*See Wartime Responsibility, OEP Order 1100.1B and Executive Order 11051.

**Communications Act of 1934, as amended, and Executive Order 10705, as redelegated.

complying with any such order or direction for preference or priority herein authorized shall be exempt from any and all provisions in existing law imposing civil or criminal penalties, obligations, or liabilities upon carriers by reason of giving preference or priority in compliance with such order or direction.

c. Upon proclamation by the President that there exists war or a threat of war, or a state of public peril or disaster or other national emergency, or in order to preserve the neutrality of the United States, the President, if he deems it necessary in the interest of national security or defense, may suspend or amend, for such time as he may see fit, the rules and regulations applicable to any or all stations or devices capable of emitting electromagnetic radiations within the jurisdiction of the United States as prescribed by the Commission, and may cause the closing of any station for radio communication, or any device capable of emitting electromagnetic radiations between 10 kilocycles and 100,000 megacycles, which is suitable for use as a navigational aid beyond five miles, and the removal therefrom of its apparatus and equipment, or he may authorize the use or control of any such station or device and/or its apparatus and equipment, by any department of the Government under such regulations as he may prescribe upon just compensation to the owners. The authority granted to the President, under this subsection, to cause the closihg of any station or device and the removal therefrom of its apparatus and equipment, or to authorize the use or control of any station or device and/or its apparatus and equipment, may be exercised in the Canal Zone.

d. Upon proclamation by the President that there exists a state or threat of war involving the United States, the President, if he deems it necessary in the interest of the national security and defense, may during a period ending not later than six months after the termination of such state or threat of war and not later than such earlier date as the Congress by

concurrent resolution may designate, (1) suspend or amend the rules and regulations applicable to any or all facilities or stations for wire communication within the jurisdiction of the United States as prescribed by the Commission, (2) cause the closing of any facility or station for wire communication and the removal therefrom of its apparatus and equipment, or (3) authorize the use or control of any such facility or station and its apparatus and equipment by any department of the Government under such regulations as he may prescribe, upon just compensation to the owners.

## NATIONAL COMMUNICATIONS SYSTEM CONCEPT AND OBJECTIVES*

In order to strengthen the communications support of all major functions of government there is need to establish a unified governmental communications system which will be called the National Communications System (NCS). It shall be established and developed by linking together, improving, and extending on an evolutionary basis the communications facilities and components of the various Federal agencies.

The objective of the NCS will be to provide necessary communications for the Federal Government under all conditions ranging from a normal situation to national emergencies and international crises, including nuclear attack. The system will be developed and operated to be responsive to the variety of needs of the national command and user agencies and be capable of meeting priority requirements under emergency or war conditions through use of reserve capacity and additional private facilities. The NCS will also provide the necessary combinations of hardness, mobility, and circuit redundancy to obtain survivability of essential communications in all circumstances.

*President's Memorandum of August 21, 1963, subject "Establishment of the National Communications System."

Initial emphasis in developing the NCS will be on meeting the most critical needs for communications in national security programs, particularly to overseas areas. As rapidly as is consistent with meeting critical needs, other Government needs will be examined and satisfied, as warranted, in the context of the NCS. The extent and character of the system require careful consideration in light of the priorities of need, the benefits to be obtained, and the costs involved.

Although no complete definition of the NCS can be made in advance of design studies and evolution in practice, it is generally conceived that the NCS would be comprised primarily of the long haul, point-to-point, trunk communications which can serve one or more agencies.

## RESPONSIBILITIES OF THE SPECIAL ASSISTANT TO THE PRESIDENT FOR TELECOMMUNICATIONS*

In carrying out his functions pursuant to Executive Orders 10705 and 10995 and under this memorandum, the Director of Telecommunications Management shall be responsible for policy direction of the development and operation of a National Communications System. In this capacity, he shall also serve as a Special Assistant to the President for Telecommunications and shall:

a. Advise with respect to communication requirements to be supplied through the NCS; the responsibilities of the agencies in implementing and utilizing the NCS; the guidance to be given to the Secretary of Defense as Executive Agent for the NCS with respect to the design and operation of the NCS; and the adequacy of system designs developed by the Executive Agent to provide, on a priority basis and under varying conditions of emergency, communications to the users of the NCS.

*President's Memorandum of August 21, 1963, subject "Establishment of the National Communications System."

b. Identify those requirements unique to the needs of the Presidency.

c. Formulate and issue to the Executive Agent guidance as to the relative priorities of requirements.

d. Exercise review and surveillance of actions to insure compliance with policy determinations and guidance.

e. Ensure that there is adequate planning to meet future needs of the NCS.

f. Assist the President with respect to his coordinating and other functions under the Communications Satellite Act of 1962 as may be specified by Executive Order or otherwise.

In performing these functions, the Special Assistant to the President for Telecommunications will work closely with the Special Assistant to the President for National Security Affairs; he will consult with the Director of the Office of Science and Technology and the Director of the Bureau of the Budget, as appropriate; will establish arrangements for inter-agency consultation to ensure that the NCS will meet the essential needs of all Government agencies; and will be responsible for carrying on the work of the Subcommittee on Communications of the Executive Committee of the National Security Council which is hereby abolished. In addition to staff regularly assigned, he is authorized to arrange for the assignment of communications and other specialists from any agency by detail or temporary assignment.

The Bureau of the Budget, in consultation with the Special Assistant to the President for Telecommunications, the Executive Agent and the Administrator of General Services, will prescribe general guidelines and procedures for reviewing the financing of the NCS within the budgetary

process and for preparation of budget estimates by the participating agencies.

## COMMUNICATIONS SATELLITE POLICY AND PURPOSE*

SEC. 102.

a. The Congress hereby declares that it is the policy of the United States to establish, in conjunction and in cooperation with other countries, as expeditiously as practicable a commercial communications satellite system, as part of an improved global communications network, which will be responsive to public needs and national objectives, which will serve the communication needs of the United States and other countries, and which will contribute to world peace and understanding.

b. The new and expanded telecommunication services are to be made available as promptly as possible and are to be extended to provide global coverage at the earliest practicable date. In effectuating this program, care and attention will be directed toward providing such services to economically less developed countries and areas as well as those more highly developed, toward efficient and economical use of the electromagnetic frequency spectrum, and toward the reflection of the benefits of this new technology in both quality of services and charges for such services.

c. In order to facilitate this development and to provide for the widest possible participation by private enterprise, United States participation in the global system shall be in the form of a private corporation, subject to appropriate governmental regulation. It is the intent of Congress that all authorized users shall have nondiscriminatory access to the system; that maximum competition be maintained in the provision of equipment and services utilized by the system; that the

*Communications Satellite Act of 1962, and Executive Order 11191.

corporation created under this Act be so organized and operated as to maintain and strengthen competition in the provision of communications services to the public; and that the activities of the corporation created under this Act and of the persons or companies participating in the ownership of the corporation shall be consistent with the Federal antitrust laws.

d. It is not the intent of Congress by this Act to preclude the use of the communications satellite system for domestic communication services where consistent with the provisions of this Act nor to preclude the creation of additional communications satellite systems, if required to meet unique governmental needs or if otherwise required in the national interest.

COMMUNICATIONS SATELLITE
RESPONSIBILITIES*

SEC. 2. DIRECTOR OF TELECOMMUNICATIONS MANAGEMENT.

a. Subject to the provisions of this order, the Director shall generally advise and assist the President in connection with the functions conferred upon the President by the provisions of Section 201(a) of the Act.

b. The Director shall:

(1) Aid in the planning and development, and aid in fostering the execution, of a national program for the establishment and operation, as expeditiously as possible, of a commercial communications satellite system.

*Communications Satellite Act of 1962, and Executive Order 11191.

(2) Conduct a continuous review of all phases of the development and operation of such a system, including the activities of the Corporation.

(3) Coordinate the activities of governmental agencies with responsibilities in the field of telecommunication, so as to insure that there is full and effective compliance at all times with the policies set forth in the Act.

(4) Make recommendations to the President and others as appropriate, with respect to all steps necessary to insure the availability and appropriate utilization of the communications satellite system for general Government purposes in consonance with Section 201(a)(6) of the Act.

(5) Help attain coordinated and efficient use of the electromagnetic spectrum and the technical compatibility of the communications satellite system with existing communications facilities both in the United States and abroad.

(6) Prepare, for consideration by the President, such Presidential action documents as may be appropriate under Section 201(a) of the Act, make necessary recommendations to the President in connection therewith, and keep the President currently informed with respect to the carrying out of the Act.

(7) Serve as the chief point of liaison between the President and the Corporation.

INTERNATIONAL TELECOMMUNICATIONS COORDINATION*

SEC. 8. The Director of Telecommunications Management and the Federal Communications Commission shall assist and give policy advice to the Department of State in the discharge of its functions in the field of international telecommunications policies, positions and negotiations.

THE ISSUANCE OF RULES AND REGULATIONS*

SEC. 9. The Director of Telecommunications Management shall issue such rules and regulations as may be necessary to carry out the duties and responsibilities vested in him by this order or delegated to him under this order.

OTHER COORDINATION*

SEC. 10. All executive departments and agencies of the Federal Government are authorized and directed to cooperate with the Director of Telecommunications Management and to furnish him such information, support and assistance, not inconsistent with the law, as he may require in the performance of his duties.

ESTABLISHMENT OF ADVISORY COMMITTEES AND WORKING GROUPS*

SEC. 5. The Director of Telecommunications Management shall establish such interagency advisory committees and working groups composed of representatives of interested agencies and consult with such departments

*Executive Order 10995.

and agencies as may be necessary for the most effective performance of his functions. To the extent that he deems it necessary or advisable to continue the Interdepartment Radio Advisory Committee, it shall serve in an advisory capacity to the Director of Telecommunications Management.

Mr. PLUMMER. If the committee wishes to have copies of this, I will be happy to supply them.

As the Acting Director of Telecommunications Management, I have been asked to appear today to review activity relating to commercial communication satellite applications resulting from research and development by the National Aeronautics and Space Administration (NASA). Since you have heard from NASA and expect to hear from Members of Congress and private corporations, I will merely present an overview of the subject as seen from the national policymaking level by the Director of Telecommunications Management (DTM).

I will treat two broad subject areas: First, the progress made toward achieving the objectives of the Communications Satellite Act of 1962 which illustrate a practical application of space technology; and second, some potential opportunities for additional practical applications.

I feel that I need not tell the distinguished members of this committee of the growing and crucial importance of telecommunication in today's world. Our Nation's social, political, and economic well-being depend in very large measure upon the telecommunication technology; and it is the interest of all of us to assure that this dynamic technology—which includes many diverse means of communicating—continues to grow.

Mr. KARTH. May I interupt you at this point, sir?

Mr. PLUMMER. Surely.

Mr. KARTH. I don't know that I have ever heard it put more succinctly than you did in this last sentence of your third paragraph. Let me just repeat it for the record. I think it requires some attention. You state that our Nation's social, political, and economic well-being depend in large measure upon the telecommunication technology. I agree with that. I think it is a very profound statement.

I would say that our social, political, and economic well-being depend in large measure upon telecommunications technology more so for example, than sending a man to the moon, wouldn't you? I hate to make that comparison, but because we have already accomplished one, and we haven't accomplished the other, unfortunately, I do think if you had to pick one or the other, which more properly fits into providing the well-being of this Nation, in terms of social and political and economic well-being, I would think it would be telecommunications, wouldn't it?

Mr. PLUMMER. I think perhaps in the shortrun that is certainly true. I wouldn't want to downgrade existing telecommunications. The United States has the best there is in the world. We can do better. We can reach more people. But it is an excellent service.

What we learned from going to the moon, and it is far beyond my ability to appraise it properly, will give us knowledge for the future. Something we have been learning from astronomers, the nature of the universe is very useful. In some decade in the future, maybe the year 2000, it will be the most valuable thing there is. I just don't know, sir.

Mr. KARTH. Well, I think it is a very profound statement, and very succinctly put.

Thank you very much. Proceed.

Mr. PLUMMER. It is equally important that the fruits of this technology be used in the interest of all of our people and in the interest of the world's peoples as rapidly and economically as possible. I am of the opinion that, in general, we, in this country, have, in fact, put

to rapid and economic use a very great part of the technology which has been developed over the past two decades.

Space technology is one of the means by which progress in telecommunication has been stimulated. It is by no means the only technology which is important or useful to the Nation and the world—it is the most dramatic.

Although the U.S. Government operates many Government-owned telecommunication systems, it relies, as a matter of policy, upon the commercial commoncarriers, except for unique governmental requirements. The U.S. Government is the largest single customer of the commercial commoncarriers. For example, the Government leased about $460 million of telecommunication facilities and services from commercial sources in fiscal year 1969.

With regard to progress in practical applications, I will first discuss the progress that has been made by the United States in using space technology in practical commercial communication applications.

The Congress in the Communications Satellite Act of 1962 set the basic goal to "establish . . . as expeditiously as practicable a commercial communications satellite system, as part of an improved global communications network." This has been largely achieved—and far more rapidly than was expected. Major milestones in the development of the global system include:

The incorporation of the Communications Satellite Corporation in February 1963.

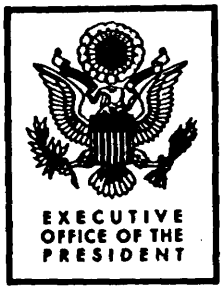
The "Agreement Establishing Interim Arrangements for a Global Commercial Communications Satellite System" August 20, 1964.

Operation of the first commercial communications satellite—Early Bird—April 1965.

Achievement of global coverage by the INTELSAT System in June 1969.

These important milestones were treated in detail in the last annual report by the President to Congress on activities and accomplishments under the Communications Satellite Act of 1962 which is provided for the record.

(The document referred to is as follows:)




# *ANNUAL REPORT*

on

# ACTIVITIES AND ACCOMPLISHMENTS under the COMMUNICATIONS SATELLITE ACT OF 1962

*January 1 - December 31, 1968*

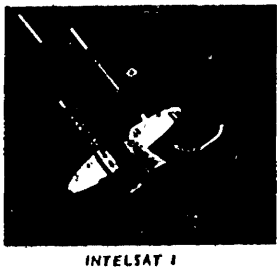
CONTENTS

TO THE CONGRESS OF THE UNITED STATES:

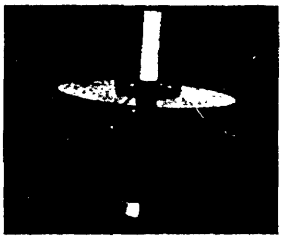
Under Section 404 of the Communications Satellite Act of 1962, I hereby transmit the sixth annual report on this program.

LYNDON B. JOHNSON

THE WHITE HOUSE
January 1969

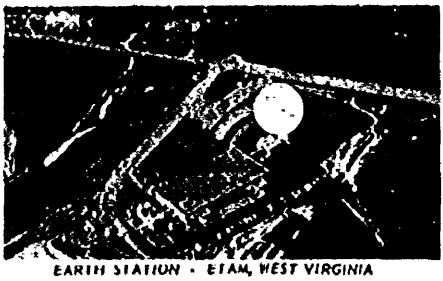


INTELSAT I

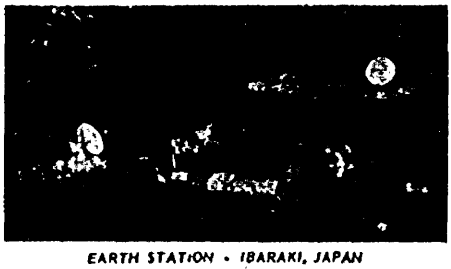


INTELSAT II

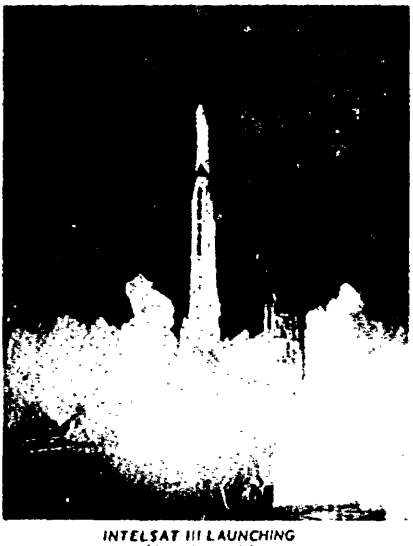
INTELSAT III



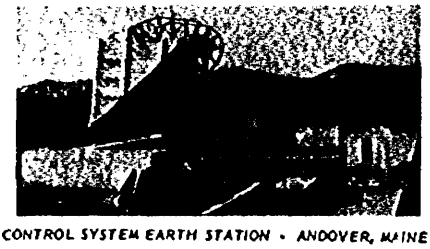
EARTH STATION • ETAM, WEST VIRGINIA



EARTH STATION • IBARAKI, JAPAN



INTELSAT III LAUNCHING
(Cape Kennedy)



CONTROL SYSTEM EARTH STATION • ANDOVER, MAINE

INTERIM COMMUNICATIONS SATELLITE COMMITTEE

Figure 1

**THE GLOBAL COMMERCIAL COMMUNICATIONS SATELLITE SYSTEM**

*(TYPICAL FACILITIES & INTELSAT'S GOVERNING BODY)*

# I

# INTRODUCTION

## Historical Background

On December 18, 1958, the world's first successful communications satellite experiment (Project SCORE) was launched from Cape Kennedy, Florida and subsequently broadcast a pre-recorded message from President Eisenhower to people throughout the world.

As the first satellite communications decade draws to a close, it is appropriate to summarize the achievements made by the free world in this new and revolutionary technology, in particular, the accomplishments since enactment of the Communications Satellite Act of 1962, and the opportunities and challenges ahead for fostering world peace and understanding through improved international telecommunications.

A progress chart depicting the various programs used to develop satellite communications during the past decade is shown in Appendix A. The locations of the earth stations and satellites of the Global Commercial Communications Satellite System (INTELSAT) are shown in Appendix B.

By its enactment of the Communications Satellites Act of 1962, the Congress of the United States enunciated national policy "to establish, in conjunction and in cooperation with other countries, as expeditiously as practicable a commercial communications satellite system, as part of an improved global communications network, which will be responsive to public needs and national objectives, which will serve the communication needs of the United States and other countries, and which will contribute to world peace and understanding." In addition, the Communications Satellite Act of 1962, declared the United States policy to be that "in order to facilitate this development and to provide for the widest possible participation by private enterprise, United States participation in the global system shall be in the form of a private corporation, subject to appropriate governmental regulations." The Communications

Satellite Corporation (COMSAT), incorporated in the District of Columbia on February 1, 1963, has served to carry out the intent of Congress.

Intercontinental telecommunications services were provided primarily by high frequency radio and submarine cable means prior to the development of communications satellite technology. The classical institutional framework for such service was established by bilateral agreement between nations involving communications common carriers (government or private entities).

The advent of the communications satellite and its potential for enhancing international telecommunications presented a challenge to the ingenuity of the United States and the international community for organizational innovation. Rather than choosing to continue the bilateral agreement approach, it was decided that new international institutional arrangements involving multilateral agreements with a large number of nations was the more desirable alternative. This approach seemed to be consistent with the profound international implications of satellite communications.

Shortly after President Kennedy signed the Communications Satellite Act of 1962, discussions began, at first with Canada and several European countries, with a view to examining ways to foster international cooperation in establishing a commercial communications satellite system. These discussions intensified in 1963 and were broadened later to include countries in other regions of the world.

The United States Government on August 20, 1964, entered into a multilateral Agreement Establishing Interim Arrangements for a Global Commercial Communications Satellite System (INTELSAT), thus affirming its policy of supporting the establishment of a Global System and of promoting the utilization of outer space for peaceful purposes. The United States Government designated the Communications Satellite Corporation as the communications entity to represent the United States in this joint venture. In addition, COMSAT was designated in the Agreement to act as the Manager in the

design, development, construction, establishment, operation and maintenance of the space segment of the communications satellite system.

Progress Summary

During 1968 progress continued to be made by INTELSAT in establishing and operating the Global Commercial Communications Satellite System. In the four and one-half years since its establishment, INTELSAT has grown from an initial membership of 11 participating nations to its year-end membership of 63 nations.

The Global System has had a steady growth in demand for service and utilization of the available capacity of the space segment. The space segment facilities of the Global System continued to render high quality telephone, telegraph, television and related services with exceptional reliability. Additional earth stations were activated in various countries during the year.

Significant milestones were achieved by the successful launching of an INTELSAT III series satellite, a new generation of improved operational satellites; and by the award of a contract to industry for more advanced INTELSAT IV series satellites.

The value of satellite communications toward enhanced international telecommunications service was demonstrated during the year by the initiation of commercial service via the INTELSAT system to the Australian and South American Continents. Users of the system have realized increased versatility and capability of international telecommunications. For example, the National Aeronautics and Space Administration used, in part, leased INTELSAT facilities for its telecommunications network in support of the APOLLO 7 and APOLLO 8 manned space operations. These accomplishments demonstrate the viability of the Global Commercial Communications Satellite System (INTELSAT).



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The Consortium has benefited from COMSAT's performance in the role as Manager for INTELSAT with the close relationships maintained by COMSAT with the entire United States space program involving NASA, DOD and industry. This institutional arrangement facilitated the accelerated rate of progress toward establishing the Global System.

The achievements during 1968 under the provisions of the Communications Satellite Act of 1962 have moved the nation and the world substantially closer to realization of our ultimate goal for improved international telecommunications services.

The progress which has already been achieved with the first two generations of operational commercial communications satellites represents a profoundly important step toward a new order of capability for worldwide telecommunications. These accomplishments accelerate the process of establishing worldwide interconnection of all modes of communication and thereby foster the possibilities for the enrichment of mankind through the sharing of knowledge. Future potentials will be limited only to the imagination, skill, and cooperation of the nations of the world in participating in this unprecedented venture in space.

## II

## NATIONAL ACTIVITIES

The keynote of the United States activities in satellite communications is the mutual support and cooperation demonstrated by the leadership and technical competence of the United States Government-Industry team, coupled with the enlightened international cooperation by the members of INTELSAT. These joint efforts enabled INTELSAT to achieve unprecedented progress toward its goals, to attain a status of an eminently successful international commercial enterprise, and to increase the participation of our partner nations in research, development and manufacture in this new field of technology.

There follows a summary of significant activities accomplished during 1968 in furtherance of our national satellite communications policy; and of the concurrent planning which has been undertaken to maintain the rapid pace of progress in satellite technology and adapt it to the needs of modern society.

### Federal Coordination and Planning

The Director of Telecommunications Management and the Department of State, in coordination with the Federal Communications Commission, continued active participation in fulfilling Executive Branch responsibilities assigned to the President in the Communications Satellite Act of 1962.

The principal activities accomplished by the Director of Telecommunications Management and the Department of State during the year included:

-- Providing guidance to COMSAT, acting as the United States designated communications entity, in actions being considered by the Interim Communications Satellite Committee (ICSC), INTELSAT.

-- Preparing for the INTELSAT conference on Definitive Arrangements convening in Washington, D. C. in February 1969.

-- Conducting an ad-hoc study of the impact on the INTELSAT system of the proposal to install a submarine telecommunications cable (TAT-5) between the United States and Southern Europe.

-- Aiding in the planning and development of the national program for the establishment and operation of the Global Commercial Communications Satellite System, particularly with regard to the use of advanced satellites and satellites for aeronautical purposes.

-- Maintaining continuous review of all phases of the development and operation of the system including activities of the Communications Satellite Corporation, particularly with regard to INTELSAT III and IV satellites.

The National Aeronautics and Space Administration (NASA) continued to provide launch vehicles and launch services on a reimbursable basis for placing INTELSAT satellites into transfer orbit for COMSAT, acting as Manager for INTELSAT; and technical assistance to COMSAT, as well as technical advice to the Federal Communications Commission.

The principal activities accomplished by NASA during the year included:

-- Launching INTELSAT III series satellites.

-- Providing technical consultation service to COMSAT in a number of instances. NASA's assistance was rendered in making facilities available for testing the INTELSAT III series satellite apogee motor. In addition, NASA made its experience available to COMSAT in connection with various aspects of spacecraft technology, and spacecraft under design, development and test.

-- Continuing to furnish technical advice and comments to the Federal Communications Commission (FCC) on a number of applications filed by COMSAT and on other matters in respect to satellite communications and earth stations.

III

## THE INTERNATIONAL TELECOMMUNICATIONS SATELLITE CONSORTIUM (INTELSAT)

### Membership

The activities of the International Telecommunications Satellite Consortium (INTELSAT) continued to expand during 1968. During the year, membership in the Consortium increased to 63 nations, with the addition of Uganda, Turkey and Iran. Also a number of other nations completed the initial steps toward joining and may be expected to complete accession in the coming months. A review of the organization's growth shows that at the end of 1964, the year in which the original agreements were signed, there were 19 members. An additional 29 countries joined in 1965 to raise total membership to 48 by the end of the year. At the close of 1966 there were 55 members as 7 new nations had joined. In 1967 the total grew to 60 as 5 nations became new members, and finally in 1968 total membership increased to its present 63 countries.

The interest and active participation of so many countries in establishing a viable and useful Global Commercial Communications Satellite System is an indication of the promise of this new mode of communications for providing improved international telecommunications services.

### Interim Communications Satellite Committee

The Interim Communications Satellite Committee (ICSC), the governing body of INTELSAT, was very active during 1968 in providing policy direction for the organization and in planning its future. A subject of major importance requiring considerable effort by the Committee was the preparation of a report to member Governments on "Definitive Arrangements" for the Consortium as required by the Agreement establishing the Interim Arrangements. The report completed in December, sets forth the Committee's alternatives on organizational

structure and operational principles for the permanent global commercial satellite organization. As required by the 1964 intergovernmental Agreement establishing INTELSAT, an international conference will be convened in February 1969 to formulate the permanent arrangements.

Other important substantive work accomplished by the Interim Committee during the year included the following:

-- Selection and approval of a contract for the advanced high capacity series of satellites, INTELSAT IV, to be available for international telecommunications service in early 1971.

-- Approval of plans for the launch and placement of the INTELSAT III satellites for service in the Atlantic and Pacific regions and, for the first time, the Indian Ocean region.

-- Approval of the final locations and the arrangements for the provision of tracking, telemetry and control stations for the Global System (Hawaii, Maine, Australia and Italy).

-- Consideration and approval of a number of new earth stations for access to the space segment.

-- Study and consideration of the use of communication satellites for aeronautical purposes.

-- Consideration of the implications of the proposed establishment by one member (Canada) of a domestic satellite system.

Definitive Arrangements for INTELSAT

The 1964 intergovernmental Agreement Establishing Interim Arrangements for a Global Commercial Communications Satellite System provides in Article IX that the governing body -- the Interim Communications Satellite Committee (ICSC) -- shall render a report not later than January 1, 1969, containing the Interim Committee's recommendations concerning the Definitive

Arrangements for an international global system which shall supersede the Interim Arrangements. The Definitive Arrangements are to follow the principles found in the Preamble of the present Agreement, which incorporates the principle set forth in Resolution 1721 of the XVI United Nations General Assembly "that communications by means of satellites should be available to the nations of the world as soon as practicable on a global and non-discriminatory basis."

The 1964 Agreement also provides in Article IX(c) that:

> the report of the Committee shall be considered at an international conference, at which duly designated communications entities may also participate, to be convened by the Government of the United States of America for that purpose within three months following submission of the report. The Parties to this Agreement shall seek to ensure that the definitive arrangements will be established at the earliest practicable date, with a view to their entry into force by 1st January 1970.

The INTELSAT Conference will be held in Washington, D. C. beginning on February 24, 1969. Formal invitations have been sent by the United States Government to the Governments of all INTELSAT member nations inviting their participation in the Conference. In addition, the United States Government sent a note to the missions of Governments which are not parties to the Agreement, but which are members of the United Nations or one or more of the specialized agencies. If such a Government has an interest in attending the Conference because it has a serious interest in the possibility of becoming an INTELSAT member at a future time, the Government of the United States would be pleased to extend an invitation to that Government to attend the Conference in an observer status. Additionally, the Secretary Generals of the UN and the ITU have been invited to be represented at the Conference in an observer capacity.

The INTELSAT Conference will convene less than five years after the Consortium was established. In this short time, the unique international commercial joint venture has achieved impressive progress toward meeting the objectives established in 1964. The successful accomplishments in introducing the

technological innovations of space communications for practical uses in international telecommunications are clearly unprecedented.

In October 1967, a United States Government proposal was presented to the Interim Committee which envisions Definitive Arrangements for INTELSAT patterned substantially on the Interim Arrangements. This proposal is structured to implement the United States policy expressed in the President's Message to the Congress on Communications Policy of August 14, 1967, as follows:

> ...We support the continuation of INTELSAT...We will urge the continuation of the Consortium in 1969. The present arrangements offer a firm foundation on which a permanent structure can be built...We seek no domination of satellite communications to the exclusion of any other nation -- or any group of nations ...I urge the Soviet Union and the nations of Eastern Europe to join with the United States and our 57 (now 62) partners as members of INTELSAT...

The President again invited wide participation in INTELSAT in his remarks at Glassboro, New Jersey on June 4, 1968, as follows:

> ...Second: I propose that we step up our efforts to develop a global satellite communications system. The United States believes that better communications are essential to mutual understanding between nations. That is why we proposed such a system in 1963. Now, more than 60 nations, large and small, have joined. We look forward to the day when the Soviet Union and the nations of Eastern Europe will join the system...

Advanced Systems Planning

The Interim Committee (ICSC) has sponsored the study of provision of aeronautical telecommunications services via satellites. The final report of a comprehensive study, conducted by industry was submitted to the Interim

Committee (ICSC) at the 31st meeting on March 21, 1968. Subsequently, the study results were provided to the International Civil Aviation Organization (ICAO).

The United States Government in conjunction with interested industry representatives, developed formal documentation concerning the application of communications satellite technology for aeronautical purposes. A Statement of Requirements and a National Plan for Aeronautical Telecommunication Services via Satellites have been approved and issued for guidance of U. S. spokesmen at international meetings.

The U. S. Government informed the ICSC in September 1968 that:

> There is, in the opinion of the United States Government, a requirement for improved air-ground communications in oceanic areas by providing reliable, direct pilot-to-controller capability for Air Traffic Control purposes and rapid communications capability between the aircraft and the ground environment for operational control...

Further, that:

> The United States Government urges the Committee to take steps to put itself in the position to respond on a timely basis to proposals for establishing an interim VHF aeronautical satellite service for operational evaluation purposes which could satisfy the near term (1970-1975) needs of air traffic control and company operational communications.*

* Extracted from ICSC Temp. 34-114E, September 20, 1968

IV

# PROGRESS IN ESTABLISHING AND OPERATING THE GLOBAL SYSTEM

## Background

The deployment of the Global Commercial Communications Satellite System by the International Telecommunications Satellite Consortium (INTELSAT) has progressed steadily since the initial operations began in June 1965. The growth of the Consortium was brought about by substantial investments by members, based upon the members' anticipated use of international telecommunications.

The initial market for international satellite communications facilities consisted of requirements identified by international telecommunications carriers who desired to augment their terrestrial plant capability. In addition, in 1965 the National Aeronautics and Space Administration offered the Consortium the opportunity to furnish leased services to provide telecommunications support for the APOLLO Manned Space Program. This service requirement coupled with other important international telecommunications requirements, both government and private, provided an impetus for the early deployment of the Global System.

An overview of the progress made by INTELSAT toward establishing and operating the Global System can be seen in Appendices A and B.

## Conceptual Framework of the Global System

The Global Commercial Communications Satellite System being established and operated by INTELSAT is based upon the unique features and spectacular performance characteristics provided by modern communications satellite technology.

Communications satellites placed in synchronous altitude equatorial (geostationary) orbit provide a unique transmission media for all types of telecommunications services. Essentially, the synchronous altitude equatorial corridor -- when active repeater communications satellites are employed -- is virtually a 22,300 mile high ionospheric belt which can be exploited to extend the range of telecommunications capability. The fundamental attributes of this revolutionary mode of communications include an unprecedented degree of versatility and flexibility together with high capacity that can be achieved at low cost.

The deployment of the INTELSAT system is based on employing a few high performance geostationary communications satellites located in orbit to provide essentially global coverage. The specific configuration of the Global System is achieved by placing the individual satellites in longitudinal location above the equator so as to optimize the coverage in (a) the Atlantic Ocean basin (b) the Pacific Ocean basin and (c) in the future, the Indian Ocean basin.

A system with these coverage and operational features enhances the availability of the satellites to a maximum number of nations. Technical control of the INTELSAT satellite operation, positioning and monitoring of the satellites status is accomplished from a select number of earth stations comprising a system control network. All satellites after Early Bird have a multiple access characteristic which enables several earth stations to use a single satellite simultaneously.

## Space Segment Development

The INTELSAT system is based on the philosophy of an integrated systems approach in both systems design (configuration) and management in the establishment and operation of the single Global System. Since a few geostationary satellites have by their very nature a characteristic of extensive geographic coverage, global in scope, the institutional arrangements of the International Telecommunications Satellite Consortium provide a logical method for applying an orderly and integrated systems

approach toward achieving the objective of establishing and operating a Global Commercial Communications Satellite System. The current configuration of the INTELSAT system with the present operational satellites as well as the present and planned INTELSAT III series satellites is shown in Appendix B.

O Operational Satellites

The operational system in 1968 consisted of two types of satellites e.g. INTELSAT I (Early Bird) and the INTELSAT II series satellites.

-- INTELSAT I (EARLY BIRD)

The first INTELSAT satellite, generally known as "Early Bird", was launched from Cape Kennedy on April 6, 1965. This satellites is positioned in geostationary orbit over the Atlantic Ocean and has been providing regular commercial service between North America and Western Europe since June 28, 1965.

-- INTELSAT II Series

The first successful launch and orbit of the INTELSAT II series was accomplished on January 11, 1967, less than two years after the INTELSAT I launch. Two additional INTELSAT II satellites were successfully launched and placed into commercial service during 1967. These launches took place on March 22, 1967 and September 27, 1967. One of the INTELSAT II satellites is positioned over the Atlantic providing commercial service between North America, Latin America, Western Europe, and Ascension and Grand Canary Islands. The other two INTELSAT II satellites are stationed over the Pacific Ocean and are used for commercial service between the United States, Hawaii, Australia, Japan, Philippines and Thailand. Each of the three INTELSAT II satellites was providing commercial grade service at the end of the year.

O Advanced Operational Satellites

-- INTELSAT III Series

The first of the INTELSAT III series of satellites was launched on September 18, 1968, but due to a launch vehicle failure, did not achieve orbit. The second INTELSAT III satellite was launched successfully on December 18, 1968 and was positioned in geostationary orbit over the Atlantic Ocean. This satellite will be placed in full commercial service in January 1969. Three additional INTELSAT III satellite launches are planned for 1969, in February, late April or early May, and June, with the satellites intended for positions over the Pacific, Atlantic and Indian Oceans, respectively.

-- INTELSAT IV Series

During 1967, COMSAT, on behalf of INTELSAT, continued its studies for more advanced satellites to handle growing system traffic requirements. In February 1968, a request for proposals based on the studies accomplished in 1967 was issued for an advanced satellite designated INTELSAT IV. A contract was placed in October 1968, calling for delivery of a prototype and four flight model INTELSAT IV spacecraft and associated equipment.

The advanced satellite INTELSAT IV will weigh about four times more in orbit and will be approximately five times more powerful than the INTELSAT III satellite series. A unique operational feature of this satellite will be provided by two steerable dish antennas that supplement the normal earth coverage antenna. These dish antennas will provide narrow, intense "spot" beams which can be pointed at the heavy traffic areas and will enable a significant increase in the number of circuits each satellite can relay.

The first INTELSAT IV launch is planned for early 1971.

Satellite Operational Capabilities

There has been a substantial growth in the size and performance characteristics of the INTELSAT satellites from the first generation model EARLY BIRD. The principal features and operational capabilities of the various types of INTELSAT satelliter are shown in Table 1.

| ITEM | INTELSAT I Early Bird | INTELSAT II | INTELSAT III | INTELSAT IV[a] |
|---|---|---|---|---|
| Diameter, inches | 28.4 | 56.0 | 56.0 | 93.0 |
| Height, inches (overall) | 47.1 | 51.0 | 78.0 | 193.0 |
| Weight, lb (in orbit) | 85 | 190 | 322 | 1200 |
| Design Lifetime (Years) | 1-1/2 | 3 | 5 | 7 |
| Total two-way telephone circuits[b], or | 240 | 240 | 1200 | 5000 to 8000[c] |
| TV Channels[d] | 1 | 1 | 4 | 12 |

[a] Parameters estimated

[b] When used with standard Earth Stations having 85 to 97-ft diameter antennas.

[c] Depending on type modulation, number of carriers per repeater, and antenna beam width used.

[d] In lieu of telephone circuits

TABLE 1
GROWTH IN CAPABILITY
INTELSAT SATELLITES

Tracking, Telemetry and Command

Overall operational control of the INTELSAT system is accomplished by specialized stations which perform tracking, telemetry and command (TT&C) functions. These stations track the individual satellites in the INTELSAT system, receive telemetry data which indicates the performance and status of the satellites, and transmit commands which control the various on-board communications and position keeping equipment. The TT&C stations are operated under lease agreements or other arrangements with INTELSAT.

The stations at Andover, Maine and Paumalu, Hawaii were placed in an operational status prior to 1968. A new station at Fucino, Italy was placed in an operational status during 1968. A fourth station located at Carnarvon, Australia will begin operations in early 1969.

Earth Station Deployment

The Special Agreement of INTELSAT requires that the technical characteristics of all earth stations be approved by the Interim Communications Satellite Committee (ICSC) prior to any earth station being permitted to utilize the space segment. The ICSC has approved 40 earth stations (excludes TT&C and shipboard stations) in 35 locations in 25 countries for access to INTELSAT satellites.

The locations of all operational earth stations and those stations planned to be placed in operation during 1969 are shown in Appendix B.

During 1968, three new U. S. earth stations, each equipped with 97-foot diameter antennas, were completed and placed into operation. These stations are located at Etam, West Virginia; Cayey, Puerto Rico and Jamesburg, California. New standard earth stations were also installed and put into operation in other parts of the world during 1968 at Longovilo, Chile, Utibe, Panama; Tulancingo, Mexico; Moree, Australia and Buitrago, Spain.

Utilization of the Space Segment

Each satellite in the INTELSAT system is accessed by a group of earth stations as listed in Appendix B. The utilization of the INTELSAT satellites increased from a total of 75 two-way voice circuits provided at the end of 1965, to 560 circuits by the end of 1968. The growth in utilization and increased use of the available capacity of the satellites is shown in Table 2. The higher capacity INTELSAT III series satellites and the increasing number of operational earth stations throughout the world are important factors in the dramatic increase in voice traffic utilization predicted for 1969.

| | | | | | |
|---|---|---|---|---|---|
| Number of Operational Satellites | 1 | 1 | 4 | 4 | --- |
| *Satellite Utilization Percent of Rated Capacity | 31.3% | 35.8% | 53.3% | 74.9% | --- |
| Number of Leased Two-way Voice Circuits (All classes of terminals) | 75 | 86 | 344 | 560 | ** 1,812 |
| ***Number of Trunk Route Miles (Estimate) | 12,000 | 12,000 | 45,000 | 75,000 | --- |
| ***Number of Circuits Route Miles (Estimate) | 215,000 | 250,000 | 1,100,000 | 1,800,000 | --- |
| Year Ending | 1965 | 1966 | 1967 | 1968 | 1969 |

* "Utilization in percent of rated capacity" figures include the effect that some non-standard earth stations are less difficult in utilizing satellite capacity.

** Predicted number

*** Distance in nautical miles -- earth station to earth station.

TABLE 2
GROWTH OF SATELLITE UTILIZATION
THE INTELSAT SYSTEM

21

The transmission of television traffic via the INTELSAT satellites has grown from approximately 40 hours in 1965 to approximately 377 hours in 1968. In addition, the INTELSAT system utilized NASA's Applications Technology Satellites (ATS I and ATS-III) approximately 294 hours during 1968.

The higher-capacity INTELSAT III satellites will allow exclusive channels to be used for television service. With this expanded capability, INTELSAT will be able to cope with the increasing demand for television service. A great future lies ahead.

Support of NASA Operations

The NASA Operational Communications System began using commercial satellite service for APOLLO support in February 1967, and the use of the INTELSAT service continued throughout 1968.

The APOLLO manned flights conducted in late 1968, included the use of satellite service to the three instrumentation ships outfitted for direct communications via communication satellites of the INTELSAT system. This provided the APOLLO Mission Director in Houston, Texas, a capacity to effect real time direction of the orbiting APOLLO spacecraft.

The availability of commercial communications satellite capability has contributed to an enhancement of the reliability of the NASA Operational Communications System to approximately 99.4 percent.

Support of Government Operations

The Department of Defense began using commercial communications satellite service in the Pacific and Southeast Asia in 1967, and use of the INTELSAT service continued throughout 1968. The addition of this new transmission mode to the other international commercial communications facilities (submarine cable and high frequency radio) used by DOD provides a significant enhancement of its total communications capability, particularly in increased diversity. For example, commercial communications satellite service has been used to effect restoration of DOD circuits during periods of commercial submarine cable outage.

Special Events

The unique capability of communications satellites to transmit live television broadcasts across the oceans was demonstrated throughout the year. Various important public affairs events of world-wide interest were relayed via INTELSAT satellites. On several occasions, when INTELSAT satellite capacity was unavailable, the transmission was accomplished by use of NASA's Applications Technology Satellites (ATS-I and ATS-III). The new INTELSAT III (F-2) satellite launched on December 18, 1968, was placed in commercial operation as a primary means for the provision of television service between Etam, West Virgina and Raisting, Germany on December 24, 1968.

Among major events relayed via communications satellites during 1968 included: the Winter Olympic Games at Grenoble, France; the Summer Olympic Games at Mexico City; various United Nations activities; the U. S. Presidential election; and Pope Paul celebrating Christmas midnight mass from Taranto, Italy.

Of special importance were the live television broadcasts of the APOLLO 7 and 8 missions including lift-off, in-flight, and recovery operations. The spectacular APOLLO 8 mission near the end of the year was a significant scientific accomplishment of this decade. The live broadcasts from the APOLLO 8 capsule allowed millions of people in the world to not merely follow, but also to actively share in the space adventures of the APOLLO crew.

V

## RESEARCH AND TECHNOLOGY

### National Aeronautics and Space Administration

Activities during 1968 related to research and development projects sponsored by NASA in the area of communications satellite technology include among others the following:

-- The design of interference measurement experiments which are required to determine the extent of interference between satellite earth terminals and terrestrial microwave relays under various atmospheric conditions and separation distances. Also, a millimeter wave propagation experiment has been designed to determine the usefulness of selected portions of the frequency spectrum above 10 GHz for earth space communications. (The foregoing experiments were developed jointly by NASA and OTM).

-- Development of advanced techniques for satellite communications applications e.g. simultaneous access of a large number of small users to the satellite system; more efficient utilization of the frequency spectrum through investigation of millimeter wavelengths and development of components at these higher frequencies; satellite aids to data relay to and from NASA mission spacecraft; and improved tracking techniques for orbit determination are under investigation.

-- NASA in conjunction with the Department of Transportation, Federal Aviation Administration completed plans to conduct a cooperative experiment at L-band (1540 MHz to 1660 MHz) as a part of the ATS-E mission scheduled for launch in September 1969. In addition, the FAA and the U. S. Coast Guard operated satellite communications terminals aboard aircraft and ships in a test and evaluation program for communications and navigation using NASA's ATS I and III satellites.

-- NASA initiated competitive contracts for defining two experimental Applications Technology Satellites (ATS F&G) to be placed in geostationary orbits in the early 1970's,

principally to explore the technical feasibility of erecting a large (30-foot) antenna structure in space and the ability to point it accurately ($\pm$ 0.1°). Subsidiary experiments are planned in the communications area: to transmit television program material to inexpensive augmented television receivers; to determine radio frequency radiation interference from the earth; to develop aircraft communications in the L-band aeronautical frequency band; to test spacecraft to spacecraft data relay and tracking; and test propagation and communication at optical frequencies using lasers and at millimeter wave frequencies using electron output devices. Other subsidiary experiments will be conducted in other applications areas such as meteorology, navigation, traffic control, as well as scientific experiments.

Communications Satellite Corporation

-- During 1968, COMSAT's research and development program involved projects related to communications satellite technology and the use of this technique in commercial system applications. These projects included studies and experiments for: multi-port, multi-beam spacecraft antennas; unfurlable antennas for VHF and millimeter wave antennas; on-board propulsion systems; multiple access techniques and equipment; satellite signal processing; bandwidth reduction techniques; demand assignment techniques; echo cancellation; spacecraft circuitry; propagation studies; reliability studies; and studies of the space radiation environment and methods of counteracting it.

VI

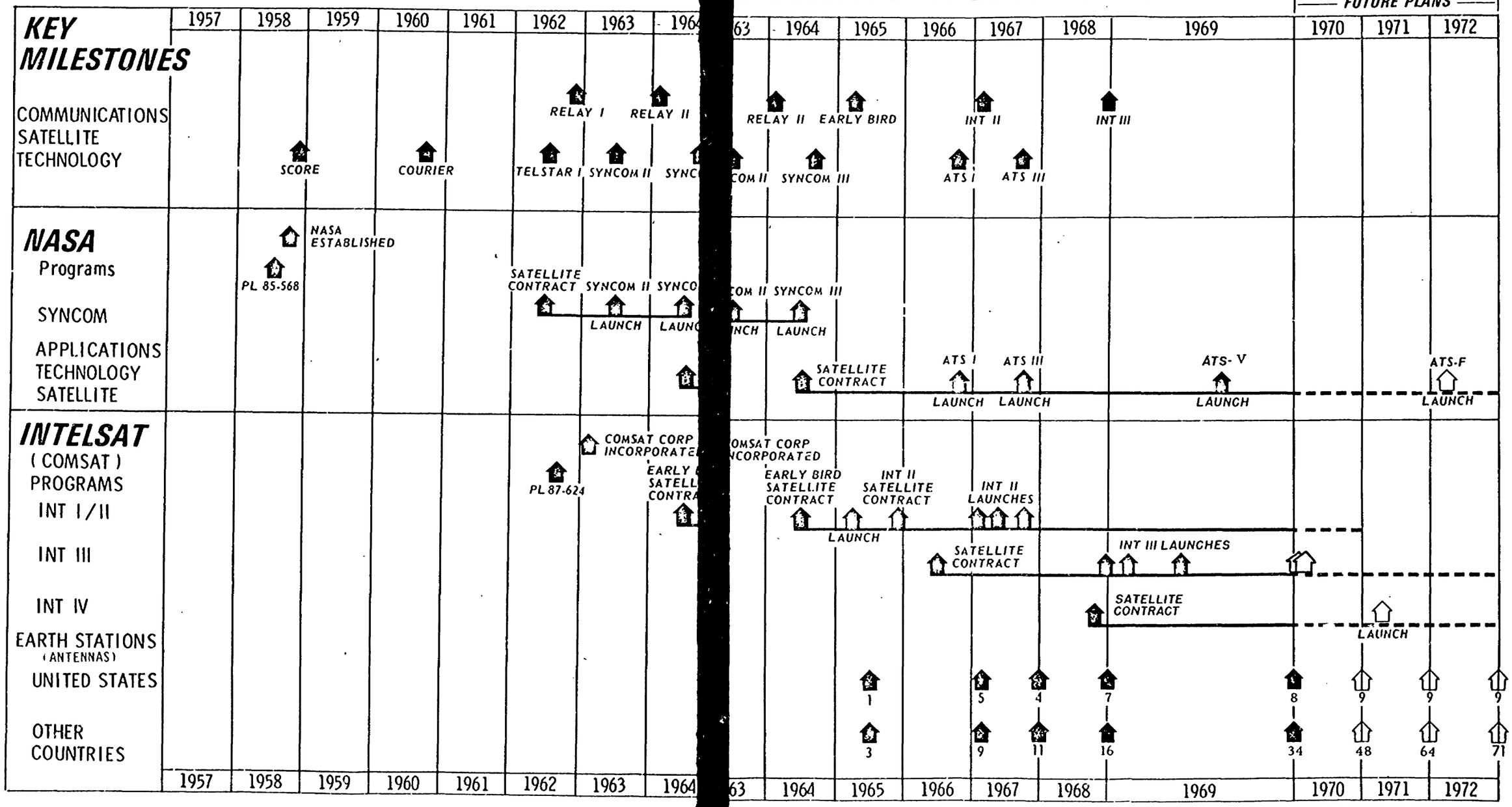
## THE CHALLENGES AHEAD

The first operational commercial communications satellite (Early Bird) was deployed to meet expanding telecommunications requirements in the high traffic volume North Atlantic region. Subsequent operational satellites (INTELSAT II's) are providing satellite capability to the North Atlantic region and to those developing nations with earth stations thereby assuring them efficient, economical, direct access to the Global System. Here the challenge is to promote further development of technology which will bring the benefits of direct access to the Global System within the economic means of any nation desiring such access.

There is an opportunity for management innovations which would be applicable to our institutional arrangements for taking advantage of the unique attributes offered by advancing technology to expand the range of telecommunications services in broader applications of communications satellites. Here the challenge is to address the complex technical, social, political and economic problems and formulate meaningful United States national and international policy.

Finally, many opportunities are presented to the nation in bringing the benefits of satellite communications to mankind. In meeting this challenge, the United States will continue to support the Global Commercial Communications Satellites System (INTELSAT) which is available to all nations -- large and small, developed and developing -- on a non-discriminatory basis.

# PROGRESS CHART
# SATELLITE COMMUNICATIONS



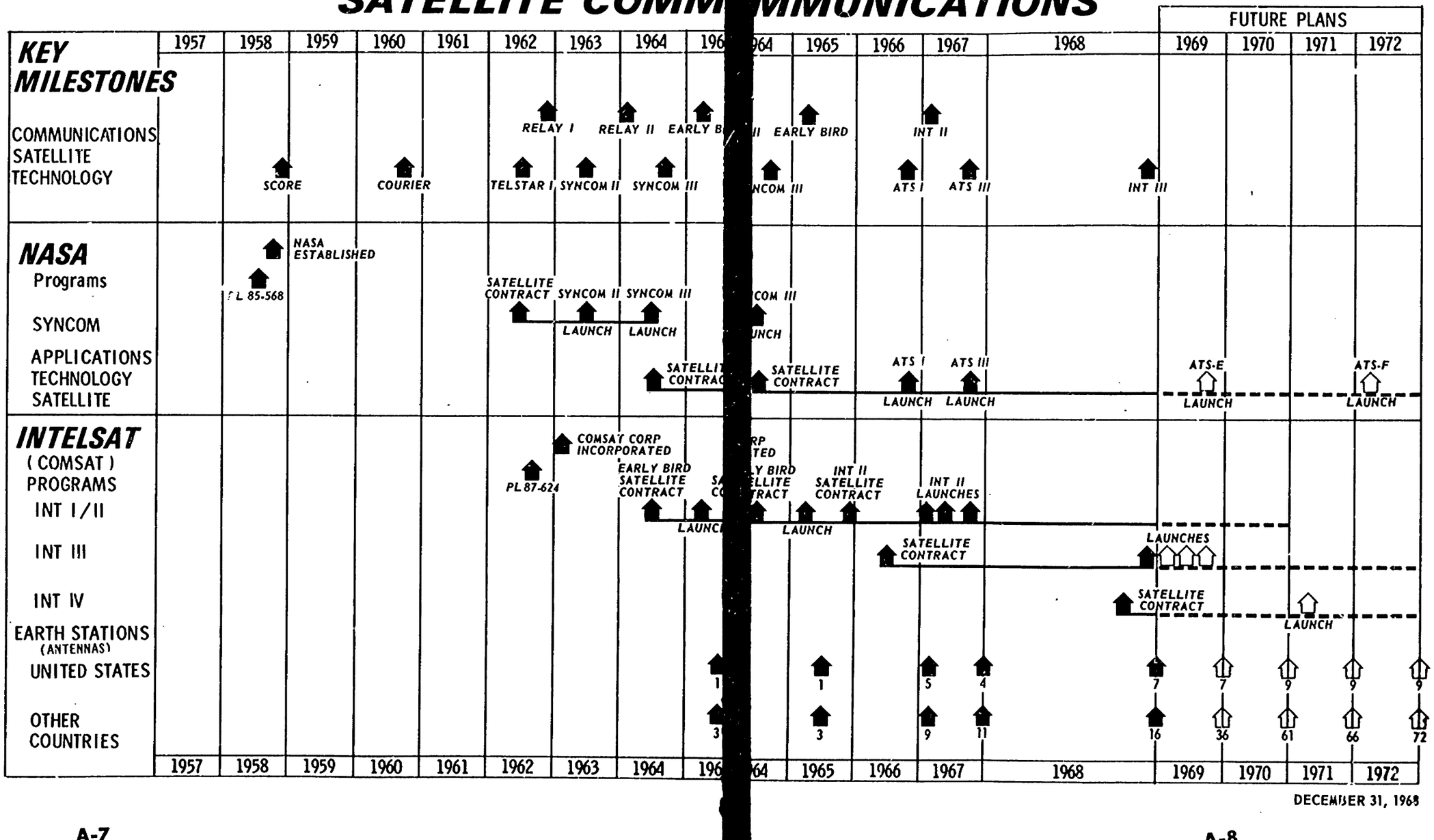

Estimated as of 15 December 1969





38-757 O - 70 (Face p. 99) No. 1

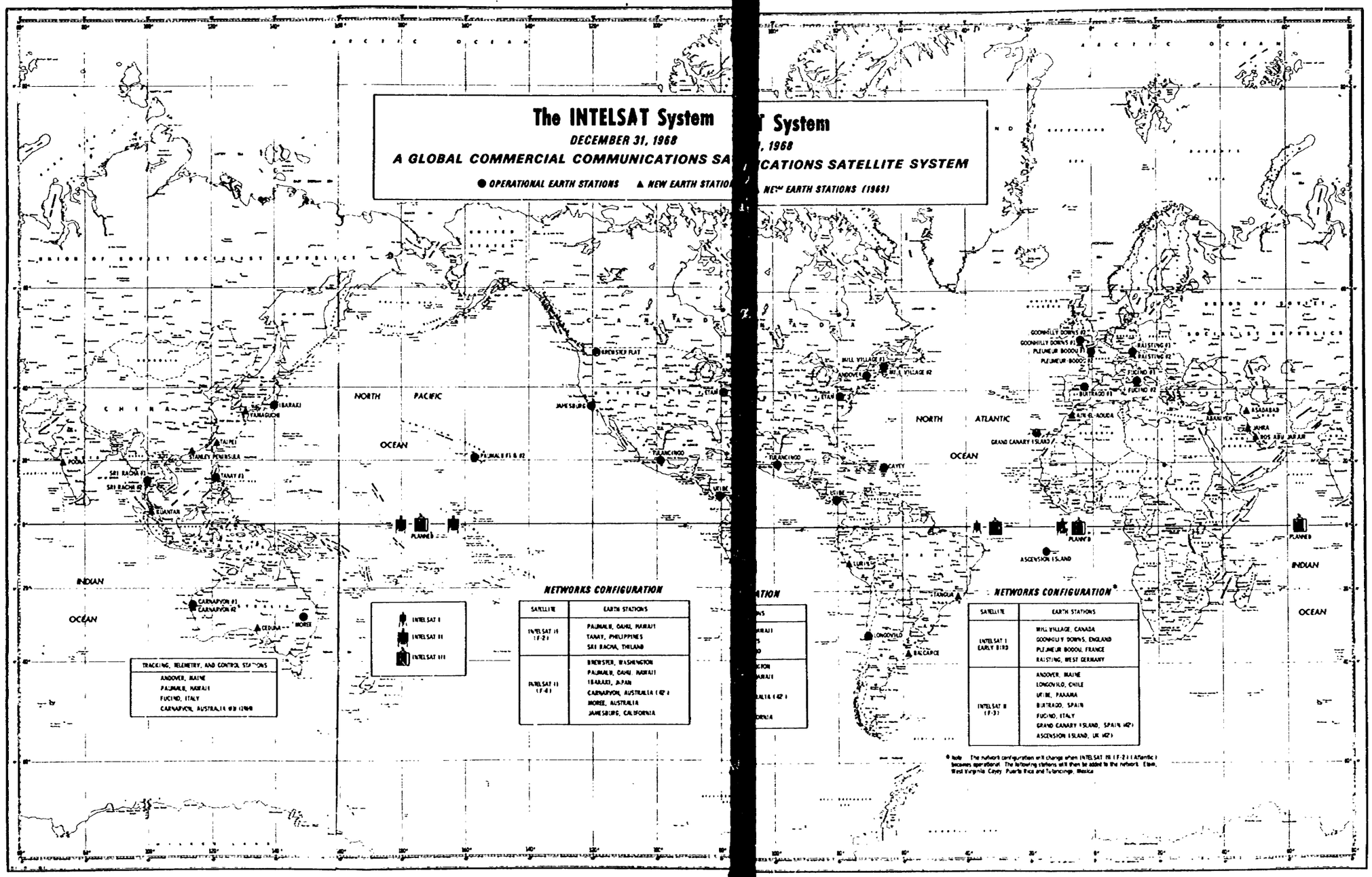
# PROGRESS CHART
# SATELLITE COMMUNICATIONS




DECEMBER 31, 1968



38-757 O - 70 (Face p. 99) No. 2






38-757 O - 70 (Face p. 99) No. 3

Mr. PLUMMER (continuing). A composite summary of the progress made in commercial satellite communications is shown in a progress chart submitted for the record.

(The progress charts referred to is as follows:)

Please note on the progress chart the development milestones in the national space program, specifically NASA's Applications Technology Satellite (ATS) project and its predecessor, the Syncom project. The results of the NASA R. & D. projects have been used in the Intelsat satellites. These important NASA developments, when combined with other advanced electronics and space technology, enable a single INTELSAT III satellite to relay simultaneously, among many standard earth stations, approximately 1,200 two-way voice circuits or four high-quality color television circuits.

The realization of the INTELSAT system has substantially augmented the international telecommunication capability for both private and government uses. The resulting benefits include significant reductions in rates for international telecommunication services.

In addition, the unique capability to provide real-time distribution of transoceanic television has added new possibilities toward rapid interchange of ideas and information among nations. Furthermore, this system has provided valuable alternate means for satisfying U.S. Government telecommunication requirements, including those of the NASA Apollo network.

The capability and versatility of the INTELSAT system were demonstrated dramatically during the astronauts walk on the moon last July. It has been estimated that more than 500 million people throughout the world witnessed this historic event as it happened.

The Director of Telecommunications Management has had a direct role in the formulation and promulgation of national policy relating to the programs which I have discussed. The following list summarizes some of the more important actions involving satellite communications matters in which my office and agencies of the executive branch, including NASA, participated:

1962–63—Formulated U.S. position for International Telecommunication Union Extraordinary Administrative Radio Conference, Geneva, 1963, which allocated frequencies for space services, and implemented final acts resulting from the conference as regards the United States.

1964—Participated in the planning and formulating of the U.S. position leading to the interim arrangements for the INTELSAT Consortium.

1965–66—Established national policy to effect Government use by NASA and DOD of leased commercial communication satellite facilities and services.

1965–66—Formulated national policy on avoiding Government facilities interference to commercial earth stations.

1967–68—Encouraged the introduction of advanced satellites and completion of global coverage of the INTELSAT system.

1968–69—Formulated U.S. preliminary views on the Space World Administrative Radio Conference to be convened in Geneva in 1971 and established an interference measurement program to provide date needed to support the U.S. position, with NASA serving as lead agency in the measurement program.

1968–69—Arranged for analysis of the electromagnetic environment for the Alaskan earth station which will provide interstate service.

It is appropriate to observe that in the early 1960's urgent needs existed for improved international telecommunications throughout the

world and that this demand presented a ready market for improved telecommunications, particularly with developing countries.

These demands provided a real stimulus for the development and growth of the global system. Furthermore, the telecommunications capability inherent with satellites provided an economic alternative to communications entities and users.

The significant progress achieved in the INTELSAT global system provides positive illustrations of the practical use of space technology flowing from the Nation's space program.

Mr. KARTH. Mr. Plummer, may I interrupt, sir? I hesitate to do this, but I really have no alternative. The bell you just heard is either a vote or a quorum call, and of course we have no authorization to sit in committee under the rules of the House, until such a time as we go over there and actually get permission on the floor, while the House is in session.

Therefore, we are going to have to adjourn this meeting, and I wonder, with your permission, if you couldn't submit the remainder of your testimony for the record at this point.

Mr. PLUMMER. Surely.

Mr. KARTH. Later on, if it is the desire of the committee, and it well may be, we may call you back to answer questions with respect to your testimony, and to explore in greater detail the policymaking authority that your office has in terms of establishing national policy in the field of telecommunications.

Would this be acceptable to you, sir?

Mr. PLUMMER. Surely, sir. I will be happy to come back.

Mr. KARTH. I am sorry the clock has defeated us on this occasion.

(The balance of the statement, not read, is as follows:)

I would welcome an opportunity particularly, not to take issue with NASA, but to extend remarks about some of the difficulties we run into in applying some of this technology in certain areas—for example, the need for frequency allocations.

### OPPORTUNITIES FOR ADDITIONAL PRACTICAL APPLICATIONS

The second portion of this statement relates to opportunities for additional practical applications of satellite technology. Since the committee has heard from NASA and will hear from several carriers, I will limit myself to identifying, without elaboration, some possible new applications of commercial communication satellites during the early 1970's:

1. Domestic applications to provide public telecommunication services (telephone, data and television distribution) within and among the 50 States, the Commonwealth of Puerto Rico and U.S. territories.

2. Domestic applications to provide intrastate public telecommunication services in the special case of Alaska.

3. Expansion of the range of public telecommunication services in international applications, for example, high speed data, demand access, and so forth.

4. International and possibly domestic applications to provide specialized telecommunication services (for example aeronautical and maritime mobile, and so forth.)

In the interest of time and due to the complexity of each item, I will only discuss the first two new applications.

DOMESTIC APPLICATIONS

With regard to the first item, we have established limited domestic application of communications satellites with earth stations located in Hawaii and Puerto Rico. Facilities are planned to be operational in Alaska during the summer of 1970.

The Nation has available a vast complex of terrestrial telecommunications except in Alaska; therefore, the requirements for additional domestic capability via the satellite medium stem from a completely different level of demand, as contrasted with the international sector. Nevertheless, the unique attributes of satellites, particularly their capability for reaching many widely dispersed locations simultaneously from a single geostationary relay, provide another alternative to the telecommunication system designer, owner, and user.

Experience in the international global system provides a model for the exploitation of new technology in practical applications. The reason for the success of the new INTELSAT enterprise, in large measure, was brought about by using a systems approach—a fundamental principle in the implementation of modern telecommunication systems. Based upon the use of planned and existing technology building blocks, the key steps of such a systems approach—emphasizing rigorous engineering and management—include the following:

Analysis of potential user needs and demands.

Formulation of a meaningful system plan (scenario) for practical application.

Evaluation of alternatives to satisfy realistic user needs and demands.

Implementation of a technically feasible and economically viable system.

The use of this method is essential if we are to preserve the integrity of existing capability and to effectuate a net enhancement of the total capability available to the people of our Nation at the lowest cost.

The potential for satisfying additional domestic telecommunication requirements by means of satellite technology has been considered by private and Government organizations for several years. There are no insurmountable technical obstacles or national policies which preclude beginning an orderly development of domestic satellite communications. I'm sure the committee recognizes that this matter is primarily within the province of the Federal Communications Commission, where it is being treated in docket 16495, notice of inquiry in the matter of "establishment of domestic communication satellite facilities by non-Government entities." However, it is widely known that the matter is currently under review by the Administration.

ALASKA APPLICATIONS

With regard to the second item, Alaska is by far the largest State in the Union with a total land area of 571,065 square miles, twice that of Texas. Alaska's population was about 284,000 in September 1969 and many people live in widely dispersed small villages remote from any population centers. With its immense size and sparse population, Alaska has by far the lowest population density of any State. In addition, Alaska is the northernmost State, and climatic and terrain conditions are by far the most difficult of those of any region in the

United States. Thus, the problems of transportation and communications for Alaska are among the most difficult on the North American continent.

All long line telephone, telegraph, and related commercial communications services have been provided in Alaska by the Government-owned Alaska Communication System (ACS) since 1901. This system is generally filled to capacity and is unable to satisfy a number of current outstanding requirements.

In accordance with Public Law 90-135, November 14, 1967, the Department of Defense is in the process of disposing of the Alaska Communications System. RCA ALASCOM Inc., the successful bidder, is scheduled to take over ownership of the ACS on July 1, 1970. Meanwhile, the COMSAT Corp. is constructing a standard earth station at Talkeetna, Alaska to work with a Pacific Ocean INTELSAT satellite and this is scheduled for operation on July 1, 1970.

Thus, today, telecommunication in Alaska is in a transitional period. The State government (Governor and Public Service Commission) has assumed primary responsibility for the planning and regulation of intrastate telecommunications. There are ad hoc efforts underway by the State government, the Federal Government and private industry to determine the trends in telecommunication needs, and to plan for terrestrial and communication satellite facilities and systems to meet these needs.

In this connection, the FCC said that it intends to hold comprehensive hearings on ownership of the Talkeetna-Anchorage microwave link and ha scheduled a prehearing conference for December 16, 1969.

With respect to communication satellites for providing intrastate service, I have a few observations. First, feasibility studies made by COMSAT and RCA indicate that the establishment of a separate dedicated satellite system for Alaska is not an economical approach. One practical approach would be to combine the coverage of Alaska with a broad-based U.S. domestic system. Second, due to the small, widely dispersed population and limited market demand, it appears that some form of subsidy by the State or Federal Government will be needed if modern telecommunication services, including television distribution, are to be provided throughout Alaska.

Based on the situation existing today, I suggest that the following steps need to be taken in realizing an orderly transition to modern communications in Alaska:

Conducting a comprehensive survey of user needs for telecommunication services.

Preparing a composite long-range plan for Alaska telecommunication providing for an optimum mix of terrestrial and satellite facilities.

Moving as rapidly as possible toward the objective of satisfying Alaska's communications needs and, where appropriate, making use of the domestic satellite system capability, when available.

I assume the ATS experiments proposed by Governor Miller to NASA would help in obtaining technical data and information to support the long-range plan.

SUMMARY

There have been significant benefits to the public in practical applications utilizing the results of NASA R. & D.

With respect to international satellite communications, we have not encountered significant institutional barriers to capitalizing on NASA R. & D.

There are opportunities for expanding the range of uses of satellite communications technology; however, orderly implementation programs should be pursued to assure maximum quantity, quality and economy of service to users.

With respect to Alaska, it is important to recognize the advantages of using a diversified, complimentary and integrated mix of both space and terrestrial telecommunication facilities, based on demonstrated needs and demands.

This completes my quick overview! Thank you, Mr. Chairman.

Mr. KARTH. We appreciate your statement very much. I think your testimony will prove to be valuable to the committee. With your permission, Mr. Plummer, we will have the staff get in touch with you and we will reschedule the meeting with you and your staff as witnesses.

Thank you very much, sir.

The meeting is adjourned.

(Whereupon, at 12:20 p.m. the subcommittee adjourned.)

# ASSESSMENT OF SPACE COMMUNICATIONS TECHNOLOGY

WEDNESDAY, DECEMBER 17, 1969

HOUSE OF REPRESENTATIVES,
COMMITTEE ON SCIENCE AND ASTRONAUTICS,
SUBCOMMITTEE ON SPACE SCIENCE AND APPLICATIONS,
*Washington, D.C.*

The subcommittee met, pursuant to notice, at 10 a.m. in room 2325, Rayburn House Office Building, Hon. Joseph E. Karth (chairman of the subcommittee) presiding.

Mr. KARTH. The committee will be in order.

Today we continue hearings on the applicability of communications satellites to domestic use. We are exploring whether the technology of communications satellites has reached a level of maturity so that it can be applied to the benefit of citizens of the United States, as it has already been applied internationally, and if not, why not?

We hope to determine whether there are institutional obstacles, or financial barriers to the utilization of this technology domestically. These and other questions we hope to have answered during the course of these hearings. Our first witness today is the Honorable Mike Gravel, Senator from Alaska, who has been in the forefront among public men urging the use of space communications systems in order to bring modern communications to the great State of Alaska. We will also hear from our colleague in the House of Representatives, Congressman Howard Pollock of Alaska.

Finally, our third witness today will be Dr. Joseph Charyk, who is president of the Communications Satellite Corp.

The first witness, recognizing that courtesy requires that the other body should take precedence on occasions like this, is Senator Mike Gravel. Would you proceed, Senator.

## STATEMENT OF HON. MIKE GRAVEL, U.S. SENATOR FROM ALASKA

Senator GRAVEL. You are very kind, Mr. Chairman. I think as a Member of the other body I will accept that deference.

I wish to apologize to the committee, and to the members of the press and the members of the audience for not having a mimeographed copy of my statement ready. My staff is in the process of preparing such. As soon as it arrives we will circulate it so that everybody can have copies who might wish to follow.

We stayed up quite late last night to formalize the presentation I am now making. Permit me to place in context some of the communications problems affecting my State, the most remote in the Union, which require immediate solution.

Alaska is larger than the combined areas of England, France, West Germany, East Germany, Poland, Czechoslovakia, and Switzerland. Its area of 586,400 square miles is larger than all of the Eastern Seaboard States combined from Maine to Florida.

However, Alaska's population is no larger than that of an average-sized American community, approximately 270,000 people. Few Alaskan population centers have more than 5,000 persons. Only 14 communities out of 300 in Alaska have a population of 1,000 or more.

Alaska has the most rugged terrain in North America. It has sea-level permafrost in many areas. Temperatures vary from minus 70° F. to plus 100° F. Average annual precipitation varies from four inches in the north to 130 inches in the southeast.

Alaska stretches 1,400 miles in one direction and 2,700 miles in another, about equal to the distance from Florida to southern California. We in Alaska have inherited the most backward communications system in the Nation. Many Alaskans have no access at all to radio or television or telephone.

In the population centers, commercial television comes 2 to 3 weeks after programs have been shown elsewhere in the United States. Alaska has no live television. Telephone costs are so prohibitive that many families cannot afford to call outside of Alaska except in an emergency.

It is very common to be told in calling to or from Alaska that all circuits are busy and to have calls delayed for hours. Alaska has no direct dialing capability. Businessmen pay a heavy premium in time and actual dollar cost for doing business in Alaska, as a result of this backwardness.

News media have pony express type communications, severely limiting the kinds of radio and television news programing and newspaper reports available to the Alaskan public.

In some communities, such things as Telex, taken for granted by persons outside of Alaska, are simply unavailable. These are problems of those who live in the population centers. They are problems of cost and convenience. Those in rural Alaska have an even greater problem. Tens of thousands of Alaskans, mainly Indians and Eskimos, live in remote villages that have no access to modern communications, save the radio-telephone.

This communications gap reflects itself in many ways, chiefly in education and problems of a cultural nature. It is difficult to attract competent teachers for isolated communities, keep them there out of touch with their teaching colleagues, out of contact with sources of assistance and research and entertainment.

It is difficult to conduct an adequate educational system where students have no contact with anything beyond their own experience, with only an occasional audiovisual aid requisition from a central supply office.

The knowledge gaps that have been bridged in rural America by the media have yet to be successfully challenged in the north country.

Compared to other areas of this Nation, my State is in the communication stone age. But as a result of the technological gains in satellite communications, Alaska's characteristics, formerly liabilities, are now ideally suited to make my State the showcase of space applications.

In other fields such as forestry, we have devastating forest fires which reduce hundreds of thousands of acres to ashes. This can be monitored by satellite and warnings issued. With oil exploration and the need to

transport this natural resource to the world's markets, effective anti-pollution systems and controls must be envisioned.

Satellite systems could help enormously and ecologically protect our area. Satellites could help locate schools of fish and other forms of marine life, which is vital to our national fishing industry. In addition, new space applications, marine safety and navigational procedures need to be devised if ever the Northwest Passage is to be navigable on a regularly scheduled basis.

Satellites can help in flood control warning as well as advising ice breakup in the spring. There are no technical or economic reasons why Alaska cannot reach these long-term goals. Every single community, including the smallest village, can enjoy television, educational television, cultural television, and commercial television.

Alaskans everywhere can have access to new biomedical diagnostic assistance. Audiovisual programs can be a part of each school's curriculum. Telephonic service can now become available to all Alaskans regardless of how remote their communities.

Alaska can also have direct outside links through international satellites, and can have a complete internal communications system, using a sensible mix of terrestrial and space facilities. Last July I proposed bringing the Apollo 11 telecast directly to Alaska.

This idea initially was scoffed at by authorities who should have known better. However, by insisting that the Department of Defense conduct appropriate military tests, we proved that it could be done. Here are the copies. I am on page 7, the middle of the page.

We employed a double satellite hop, using first a civilian satellite and then a military one to transmit TV for the first time to Anchorage—live TV. It was the longest live television transmission in history. And that is leaving out the leg from the moon to earth.

Alaskans along with their fellow Americans saw Neil Armstrong impress man's footprint on the moon.

Now we are working on another step toward permanent, adequate communications—a pilot program to bring educational and cultural TV to several Alaskan communities using NASA's ATS-1 satellite. NASA has agreed in principle to the use of the satellite and many communications companies are assisting us.

If the technology exists to do this for Alaskans, why do we not have domestic satellite communications for the entire United States? And, gentlemen, I think that is the substance of the goals that we are all seeking.

Ten countries have or are building domestic or regional satellite communications systems. Many other countries are in the process of formulating similar plans for domestic systems.

How large will our embarrassment be in three years when the greatest power on earth has become second rate to India in the field of communications?

Realizing what I have just said, I think you gentlemen, like myself, would certainly be remiss by not asking why the United States, which financed and pioneered this satellite technology, is falling behind the rest of the world.

The issue has been complicated by a battle of commercial giants. For the last 5 years or more, commercial communications carriers have locked horns with the Communications Satellite Corp. (COMSAT). The broadcasters have wrestled with the American Telephone & Tele-

graph Corp., and the public broadcasting interests, siding with educators, have fought the lot of them.

Sitting in the center of this storm has been the Federal Communications Commission. And in the true spirit of submariners who know what to do when a storm is blowing, the FCC dived and bottomed out of sight for 5 years.

When the FCC surfaced last summer, the White House sat on their hatch, hooded their periscope, and told the FCC to do nothing until the new administration could review the whole issue of a domestic communications satellite system. The White House said it would have a report in 60 days; that is, October 1, 1969.

The FCC is bobbing along, doing nothing. The White House has yet to release its report. We are now at 123 days, and still counting.

Let us review for a moment what pressures are brought on this issue by the various interests involved. COMSAT was authorized primarily to satisfy international communications traffic. Its enabling legislation is clear on that point.

Only passing reference is made to domestic applications. Obviously this serves the interest of domestic carriers which sit on COMSAT's board of directors. Only after domestic satellite systems were applied for by the American Broadcasting Co. and the Ford Foundation did COMSAT bring forward its proposal.

I believe there are two fundamental reasons for COMSAT's lack of real enthusiasm for domestic satellite communications. The first is obvious—the obvious conflict of interest in having commercial and competing industrial representatives sitting on COMSAT's board of directors Secondly, COMSAT has been consuming all its energies in trying to pursue an international role.

COMSAT is the only program manager of the International Satellite Consortium, called INTELSAT. As such, it operates as its agent. There can be no question that as its agent, COMSAT has found itself in conflicting positions regarding potential domestic applications.

Let me cite an example of this conflict. The U.S. taxpayer is subsidizing foreign interests in INTELSAT by at least $4 million. These same interests are attempting to dilute the U.S. position in world communications.

COMSAT has not been billed for $4 million by NASA for launch services. The reason it has not been billed was to save COMSAT the embarrassment of charging these costs to INTELSAT. This would have placed INTELSAT in the dilemma of paying these costs itself and apportioning them to future launches, or transferring the costs to international satellite users.

The end result of these machinations is that the American taxpayer is supporting a $4 million burden which should be paid for by private users around the world.

While this generosity was occurring, our European partners in INTELSAT met secretly in European capitals to develop a plan to restructure the voting arrangements in INTELSAT to reduce the U.S. position from 50 percent to 5 percent and to substantially increase their own voting strength to 35 percent and to increase the voting influence of developing countries to 45 percent. I would like to submit a document for the record on this matter.

EUROPEAN CONFERENCE ON SATELLITE COMMUNICATION

SCL/CD. 13/6F,
20 January 1969.

ACTING COMMITTEE

London, 21-22 January 1969

A contribution of the CEPT [French for: Conférence Européenne des Administrations des Postes et des Télécommunications (Conference of European Postal and Telecommunications Administrations)] to those points of the acting committee's report to the Governments that are of particular interest to the European Telecommunications Administrations.

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BERN, *January 17, 1969.*

DEAR MR. PRESIDENT: The Coordination Committee for Satellite Telecommunications [CCTS] of the CEPT met in Lausanne from January 14-16, 1969. During this meeting the CCTS examined the report to the Governments prepared by the Acting Committee at its 36th session. (Doc. ICSC 36-58). It mainly concentrated its attention on the study of some questions which are of greatest importance to the European Administrations of Telecommunications, that are members of the CEPT.

I have the honor to forward to you enclosed a contribution which had been brought into focus and was approved by the CCTS as a result of its study. The Telecommunications Administrations of the CEPT would be particularly happy, if the study of this paper by your Committee would induce it to make specific recommendations to the Governments in view of the forthcoming negotiations which would be interesting to them as well as to their users.

The CCTS has given its approval that this paper of the CEPT be presented at your next meeting on January 21 and 22, 1969 by Mr. H. R. Probst of the Swiss delegation. Mr. Probst as well as all the other participants in this meeting, who will be present in London, have contributed to the elaboration of this paper by the CCTS; they will gladly give you all the additional information you might need.

Yours very truly,

THE PRESIDENT OF THE "TELECOMMUNICATIONS" COMMISSION
OF THE CEPT AND CCTS.

Enclosures: (as indicated above). Mr. A. F. K. Hartogh, President, European Conference for Satellite Telecommunications.

APPENDIX 1.—FINANCIAL ADMINISTRATION RECOMMENDED BY THE CEPT TO INSURE THE FINANCIAL EQUILIBRIUM AND THE ECONOMIC DEVELOPMENT OF THE ORGANIZATION

1. Before a definite administration becomes effective—as for instance in the fall of 1969—the Signatories who wish to utilize the world system are invited to indicate the number of full time circuits or their equivalent (expressed in year circuits) which they will pledge to reserve for the Organization (under the condition, of course, that such circuits will be available) for a future convenient period.

2. The year circuits which have thus been guaranteed by the signatory, for instance, for a 4-year period, that is from 1970 to 1973 inclusively, and the year circuits that have been actually utilized in 1969, could be expressed in the percentage of the total of the year circuits from 1969 to 1973, and this percentage would furnish the basis which would give the signatory the right and the obligation

(*a*) to participate in the Organization on the basis of the net value of its possessions on January 1, 1970.

(*b*) to contribute to the capital expenses and to the Organization's operating and maintenance expenses in 1970.

(*c*) to receive a share of the Organization's receipts in 1970.

3. When the net value will be determined on January 1, 1970 and later, if necessary, one should use—in order to avoid difficulties which a special evaluation of the Organization's possessions could present—an evaluation method similar to the one that has been applied up to the present when new signatories join the Organization, that is, one should take as a basis the Organization's cumulated

net cash flow (capital expenses, operating and maintenance expenses less receipts obtained up to the date of the evaluation) and to apply an appropriate interest rate.

4. Prior to the end of 1970, the Signatories will be invited to guarantee the utilization of the circuits announced for the fifth year (1974), the actual utilization in 1970 and the utilization guaranteed for the following four years (1971-1974) could serve as a basis for:

(*a*) the adjustment of the participations indicated in point 2(a),

(*b*) the payment of the contributions and the distribution of the receipts of 1971 according to points 2 (b) and (c).

5. The adjustment as indicated in paragraph 4(*a*) would bear upon the net value of the system on January 1, 1971 and be evaluated according to the principles described in 3.

6. It would devolve upon the Organization to decide if the adjustment indicated in point 5 should be made yearly or in longer intervals.

7. Utilization dues would be established by the Organization in accordance with the commercial principles, that is, in general according to the principles described in Article 9 of the present special Accord.

8. Notwithstanding these arrangements, dispositions would be made on the understanding to guarantee to all the Signatories of the present Accords the possibility to be a party in the permanent Organization, if they so desire, and to grant them, for instance, minimal shares.

9. At the end of the system's planning, the Organization could ask the Signatories from time to time to furnish estimates of their needs for a period of several years beyond the guaranteed period without affecting the number of guaranteed circuits. The Organization should likewise be in a position to furnish a reserve allowance for unexpected needs.

## Appendix 2 to Document CCTS (69) 1.—Conference of European Postal and Telecommunications Administrations Coordination Committee for Satellite Telecommunications

A contribution of the CEPT to the points of the INTELSAT Acting Committee's report to the Governments (Doc DCSC-36-58) that are of particular interest to the European Telecommunications Administrations.

### 1. STRUCTURE OF THE ORGANIZATION

*1.1 Assemblies*

The CCTS on this subject has pointed out first of all that a substantial majority of the members of the Acting Committee recommended that the final dispositions be contained in the two connected accords (paragraph 570 in the Acting Committee's report) and that the Acting Committee furthermore unanimously recommend that under these conditions the first of the two accords be signed by the Governments (Parties) and the second one by the Governments (Signatories) (see paragraph 574).

The CCTS furthermore declares that, if a majority of the Acting Committee's members are in favor of an Assembly composed of all the Parties, a no less important number of representatives have voted for paragraphs 247 to 251, thus implying indeed the necessity of making provisions for an Assembly of the Signatories of the second Accord.

The Acting Committee by this acknowledged the fact that certain questions, to be discussed at the level of the Assembly of a telecommunications organization whose principal aim is to furnish the space sector for the public services of international telecommunications on a commercial basis (paragraph 195), fall within the competence of the telecommunications organizations. Principally involved are financial, technical and operational questions.

At the end of a thorough discussion, the CCTS unanimously acknowledged the fact that in view of the diversity of the questions to be discussed at the Assembly level and in due consideration of the responsibilities in this matter, the only logical solution to this very important problem consists in establishing two distinct Assemblies of which one be composed of the Parties and the other one of the Signatories. For your guidance, a list of the two Assemblies' functions is given below:

*1.1.1 Assembly of the Parties*

The Assembly of the Parties has the necessary powers to define the general outlines of the Organization's management; it makes the decisions in the political sphere.

It supervises the carrying out of the Accords and examines the problems that could arise in this connection.

It amends the dispositions of the intergovernmental Accord (for instance, an eventual extension of the number of services, an eventual reorganization, etc.)

It elects its President.

It elects the Countries that could be represented in the executive body, when their membership status is not determined on the basis of their portion of investments.

It elects the judicial experts of the arbitration court.

It handles the political questions which are submitted by the executive body.

It formally records the new additions to the intergovernmental Accord.

It formally records a Party that cannot use its right to vote due to the fact that it has not fulfilled its financial obligations.

1.1.2. *Assembly of the Signatories*

The functions of the Assembly of the Signatories are principally the following:

To elect its President.

To examine the medium and long term satellite programs.

To examine and approve the amendments to the second Accord.

To receive, examine and eventually approve the reports of the executive body.

To handle all questions within its jurisdiction that are submitted by the executive body.

To study the complaints that are submitted by the signatories or by the users of the systems.

To determine, in the event of a conflict, the competence of the executive body.

To formally record the additions to the second Accord.

To formally record a Signatory that cannot use his right to vote due to the fact that he has not complied with its financial obligations.

1.2. *The Executive Body*

The functions assigned to the Executive Body will be those which are required to direct the affairs and fulfill the aims of the organization. As the Acting Committee during the temporary administration, the Executive Body is directed to conceive, elaborate, build set up, maintain and operate the Space sector.

The Executive Body plays within the framework of the Organization the role of an Administrative Council. An administrative body headed by a general manager is placed under it.

*1.3 The Administrative Body*

The General Manager of the Administrative Body should be assisted by several specialized directors who jointly form the General Management; for example, an administrative director (personnel problems and contracts), director of financial and commercial matters (particularly responsible for the study of prices and supplies), technical director (research, projects, recommendations, cash expenditures), director of operations (traffic, satellite operational management), director for planning and programing operations, director for equipment and material. The General Manager and his directors will, on the basis of contracts, very extensively utilize the services of the national or international organizations that are charged with specific tasks.

The constitution of such an organization requires a long period of studies especially with regard to the statutes of the Administrative Body, Executive Body, the Directors and the functional operations of the assignments of all its echelons.

One is thus induced to think of setting up as nearly as possible a temporary office for the detailed study of the above-mentioned problems. This office would, furthermore, be aided by an organization on a contract basis specialized in the study of society organizations.

The members of this office should, in addition to a legal expert, be composed of specialists whose competence would be similar to that of the directors who are members of the General Management of the Executive Body.

In view of the time necessary to carry out this study, one should very probably conserve a certain amount of time for the present Manager.

2. FINANCIAL QUESTIONS

The Coordination Committee for Satellite Telecommunications of the CEPT has studied and taken note of the financial dispositions for which the Acting Committee had expressed its preference, especially with regard to the paragraphs 493, 498 and 511. Although the CCTS does not find all these recommendations entirely unacceptable, it has in particular expressed a great preference for dispositions according to which the investment shares should also be based on the Signatories' future needs—needs expressed in satellites' capacity—rather than expressed only on the basis of the actual utilization during the preceding year (paragraphs 498 and 511). Such dispositions would likewise permit the Signatories to benefit, in exchange for their investment, from the right to utilize the capacity necessary to satisfy their future needs. On the other hand, in accordance with the presently enforced financial arrangements and, likewise, in accordance with the dispositions for which the Acting Committee has expressed its preference, the Signatories do not receive any right to capacity utilization in return for their investments.

The financial system proposed by the CCTS appears to it [Coordination Committee for Satellite Telecommunications?] as the best system to assure the financial equilibrium of the Organization and its economic development due to the fact that it obliges the Signatories to contribute to the capital expenses as well as to the operation and maintenance expenses in proportion to their declared utilization and their circuit needs forecasts for a specific period. Furthermore, each Signatory should pledge to pay fees for the utilization of the satellite system on the basis of his forecasts. Such an objective could be obtained by applying the dispositions described in Appendix 1 to this contribution.

3. DISPOSITIONS AS TO THE VOTING IN THE EXECUTIVE BODY

The CCTS agrees with the CETS that the weight of the vote in the Executive Body should be based on the signatories' investment shares in such a way that the difference in the weight of the vote between the signatory with the largest shares and the signatory with the smallest shares of investment be smaller than the difference between their respective shares.

"In this respect, the CCTS wishes to draw the CETS's attention to recommendation No. 393 in the Acting Committee's report."

As a matter of fact, such a recommendation allows to arrive at the result desired by the CETS's proposal. This result is obtained, as recommendation 393 suggests, by establishing a direct relationship between the weight of the vote and the owned investment shares for the signatory or the group of signatories, respectively, who have their seats in the Executive Body and, furthermore, by allocating to this signatory or this group of signatories a number of the basic vote.

In order to enlighten the CETS as to the results to which the method proposed in No. 393 would lead, the CCTS has calculated the weight of the vote of the principal signatories, particularly, that of the United States and the European countries, assuming that the basic votes represent 25 and 50% of the total votes (see appendix). It was likewise accepted that the Executive Body be composed of 20 members of whom seven represent Europe which is 1.25 or 2.5 of the basic vote per member, and that 10% of the investment shares would not be represented in the Executive Body. The calculations were made on the basis of the shares for the 1970 traffic with the exclusion of the national traffic, inasmuch as the Acting Committee had unanimously recommended that the Organization's principal aim was to furnish the space sector for the public services of the international telecommunications (number 195 in the report).

These calculations have been made only for illustrative purposes.

"By expressing this point of view to the CETS, the CCTS wishes to attract its attention to the following considerations:

(*a*) The principal objective should be to strengthen Europe's relative influence.

(*b*) It is reasonable to take notice of only the international utilization in order to determine the weight of the vote in an international consortium.

(*c*) Yet, one must not expect that all the other members will consider it wise to strengthen Europe's relative influence by the two successive means given below:

(i) Exclusion of the domestic traffic and

(ii) application of the concept of "basic vote" for the international traffic.

(*d*) inasmuch as we have here a commercial consortium of international tele-

communications organizations, the relative augmentation of Europe's weight of vote with the aid of such arrangements as the "basic vote" should be only of limited importance and conform, in any case, with the individual interests of the European countries.

The CCTS's examination of the weight of the vote has shown that, even if it were required that decisions on important questions be decided by a ⅔ majority of the total of the votes represented in the Executive Body, as suggested in number 419 of the report, no satisfaction is given to the recommendation made in number 405 according to which no member or group of two or three members of the Executive Body representing the largest weight of the vote, should be able to prevent or impose a decision on the Executive Body. It is, therefore, necessary to introduce more dispositions of the sort provided for in Number 420, that is, a double majority that requires in addition to the ⅔ majority of the total vote, a simple majority of the members of the Executive Body.

4. DEFINITION OF THE REGIONAL SYSTEMS

The CCTS had an exchange of views with regard to the definition of the regional systems listed under Number 162 of the "ICsC–36–58" report in an effort to try to find a formula which would better meet the wishes of all the members. For lack of time, it was not able to find at this meeting a satisfying solution to this question.

The French delegation at this meeting has voiced its utmost reserve with regard to this definition for the reason that it could be of a sort likely to leave the participation of the French Administration of the PTT in the future Organization open to question.

The Belgian delegation has likewise voiced its reserve concerning this definition as it believes that is contrary to the conception of the European satellite.

APPENDIX 2.—WEIGHT OF VOTE

| | Number of seats | Shares of investments national traffic excluded (percent) | Without basic votes (percent) | Basic vote 25 percent | | | Basic vote 50 percent | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Investments | Basis | Total | Investments | Basis | Total |
| United States | 1 | 31.6 | 35.1 | 26.3 | 1.25 | 27.55 | 17.5 | 2.5 | 20.0 |
| CEPT | 7 | 28.0 | 31.1 | 25.3 | 8.75 | 32.05 | 15.6 | 17.5 | 33.1 |
| Japan | 1 | 5.0 | 5.6 | 4.2 | 1.25 | 5.45 | 2.8 | 2.5 | 5.3 |
| Australia | 1 | 2.7 | 3.0 | 2.3 | 1.25 | 3.55 | 1.5 | 2.5 | 4.0 |
| Canada | 1 | 2.5 | 2.8 | 2.1 | 1.25 | 3.35 | 1.4 | 2.5 | 3.9 |
| Other signatories | 9 | 20.2 | 22.4 | 16.8 | 11.25 | 28.05 | 11.2 | 22.5 | 33.7 |
| Total | 20 | 90.0 | 100.0 | 75.0 | 25.0 | 100.00 | 50.0 | 50.0 | 100.0 |
| Signatories not represented | | 10.0 | | | | | | | |
| Total | | 100.0 | | | | | | | |

The data given here are based on Document ICSC 33-28. Several administrations have pointed out that these figures are susceptible to modifications.

Senator GRAVEL. I hope that Dr. Charyrk, president of COMSAT, who will be following me with his testimony this morning, will give us a progress report on the current status of the INTELSAT negotiations.

Mr. Chairman, I assume we are looking at those agencies expected to participate in executing domestic satellite communications. We have discussed COMSAT and the FCC. Let us briefly look at the operations in NASA.

NASA will orbit every communications satellite serving the non-Soviet bloc nations, such as France, Germany, and Canada.

Moreover, NASA will develop the most advanced communications satellite, costing more than $40 million, for India.

On September 18, 1969, the United States of America and the Government of India signed a memorandum of agreement for a bilateral project whose official title is "The India/United States ITV Satellite Experiment Project."

Gentlemen, consider how well this project fits into a U.S. system. I personally do not begrudge such a project for India, since we know the desperate need. However, I do begrudge the thinking that excludes a similar application in the United States, since the American taxpayer is paying more than $40 million for one ATS-F satellite.

At this point it should be recognized by all that the United States is willing to provide satellite communications for India, but unwilling to do it for ourselves.

Mr. Chairman, we can sit here as responsible public officials and deprecate COMSAT management, the perfidy of foreign interests, the generosity of NASA programs, and the lack of aggressiveness of two national administrations in the field of communications.

But the truth is that we in Congress would be less than honest if we left the indictment there.

It was Congress that assigned COMSAT the duty of developing and managing an international communications satellite system. It was also Congress that neglected to clearly assign a similar responsibility to met our domestic needs.

This oversight has resulted in the lack of utilization of communications technology in the United States during the recent decade. In fact, we have been exporting the benefits of our own hard-earned technology without employing those benefits ourselves.

At the risk of being too philosophical, let me say that man's greatest problem is communicating with his fellow man.

I applaud this committee for addressing itself to this problem—for addressing itself to the opportunity for solving the population problem of India, providing a vehicle for the acculturation of Eskimos in the far reaches of the Arctic, providing our ghetto population with the necessary training and education, and bringing to all Americans cultural enrichment far beyond existing horizons.

We now have the opportunity to bring about a greater degree of communications to satisfy all appetites and all needs.

The technology exists. What a crime not to use it.

In the wake of our great accomplishment—putting a man on the moon—a great deal of reexamination of our priorities is taking place.

This Nation has built up a tremendous industrial infrastructure in pursuing our space goals of the sixties. I would hope that this Congress will find the wisdom and develop the policy of providing Americans as well as others with the vital benefits of better communications.

Thank you, Mr. Chairman.

Mr. KARTH. Thank you very much, Senator, for a very enlightening statement. This committee is grateful to you for traveling to this side of Capitol Hill to give us the benefit of these thoughts so very well expressed in your paper.

I am sure you are aware of the fact, Senator, that this committee really has very little jurisdiction in the whole question of whether or not the Federal Communications Commission has met its obligations, or whether for that matter other agencies of the U.S. Govern-

ment have met their obligations, other than the one agency that we do have some responsibility for, and that is the National Aeronautics and Space Administration.

However, the distinguished chairman of the full committee, Congressman Miller, of California, after a number of discussions with many others on this question, felt that we could investigate the questions that I suggested at the beginning of the hearings yesterday and again today. Within that limited jurisdiction, we are moving forward, and whatever comes out of these hearings will be furnished to other appropriate committees of the Congress for whatever action they deem desirable.

Again I want to thank you very much for appearing before the committee and giving us the benefit of your views. Obviously, there has been extensive research on your part.

Mr. Mosher.

Mr. MOSHER. Senator, on page 5, you suggest that your State—and it is a great State and potentially an even greater State—should be a showcase, that is the word you used, for space applications in electronic communications. And on page 15 you suggest that it is a crime that it is not being made a showcase and that we are not moving ahead with this technology.

You refer to the White House attitude and suggest that it is very hesitant to make a decision that should have been made. Have you and others in official capacity in Alaska gone to the White House with a step-by-step positive program of recommendations as to what should be done, and can you give this committee what the first step should be and then the second step?

How do you see we should move here?

Senator GRAVEL. Well, the first point, we have gone to the White House. We have been in very close contact with them. We can supply for the record all of our correspondence. When we developed a plan, this 9-month plan that we are talking of, to tie in four Alaskan communities, we wrote out the plan and submitted it initially to the White House.

U.S. SENATE,
*Washington, D.C., May 26, 1969.*

Hon. WILLIAM W. SCRANTON,
*Chairman of the U.S. Delegation to the Intelsat Conference, Department of State, Washington, D.C.*

DEAR MR. CHAIRMAN: Permit me to congratulate you on your assignment as the President's principal American representative to the vitally important Intelsat Conference.

I am personally very interested in efforts to establish a definitive agreement, and am most anxious that the final agreement be such as to allow the State of Alaska to have access to all communications satellites which can be exploited for cultural and educational transmissions as well as for commercial, subscriber communications.

The broad applications for long-distance communications go well beyond the notions of traditional communications. The remoteness of some Alaskan area precludes a rigid Intelsat definition of satellite exploitation if this rigidness would force Alaskans to go without modern audio-visual and telephonic facilities.

For example, should the Canadian TELESAT system provide portions of Alaska access to modern communications faster and more economically than another space project, then Alaska should be able to opt for this access. I single out TELESAT since, for the moment, its planned coverage of neighboring Yukon and British Columbia is the only coverage which could with appropriate agreements, be a rapid step forward for Alaska in modern communications.

At the moment my state has the worst communications system under the American flag. While I can understand the circumstances that developed this situation, I do not think it is proper to sanction anything less in the way of improvements then technology can make available.

I would appreciate the benefit of your thinking on this problem and the opportunities presented by recent technological breakthroughs.

Sincerely,

MIKE GRAVEL.

DEPARTMENT OF STATE,
*Washington, D.C., June 12, 1969.*

Hon. MIKE GRAVEL,
*U.S. Senate.*

DEAR SENATOR GRAVEL: You asked in your letter of May 26 for my thoughts on communications with Alaska via satellite.

The proposals we have made for definitive arrangements for INTELSAT would not interfere with establishment of facilities for satellite transmission to Alaska. We are asking for a broad scope of authority for the INTELSAT organization so that it could provide such satellite telecommunication facilities as the parties to the agreement may request, so there would be no obstacle if at some later date something specific is wanted from INTELSAT.

We are also asking that member countries be free to establish satellites outside the INTELSAT system to carry domestic traffic, with no qualifications except technical coordination with INTELSAT. Under this concept of the definitive arrangements, there would be no obstacle to transmission of domestic traffic between Alaska and the rest of the United States via the Canadian satellite, assuming this was arranged with the approval of the authorities of both countries. Our proposals for the definitive arrangements also would not prohibit satellite systems outside INTELSAT carrying international traffic, such as traffic between Alaska and Canada, on the Canadian satellite, but would require a determination by the INTELSAT Governing Board that such use of the outside system would not be economically damaging to INTELSAT.

There is, of course, no barrier in the INTELSAT arrangements to use of the INTELSAT system by Alaska today, and, as you are no doubt aware, ComSat plans and the FCC has approved an earth station, to be located north of Anchorage, for that purpose. (ComSat's release of June 4 announcing the award of a contract for construction of the station said it is to be completed in the late summer of 1970.) I assume this will be helpful, though it of course does not solve the problem of onward transmission to remote areas.

Sincerely,

WILLIAM W. SCRANTON,
*Chairman, U.S. Delegation, INTELSAT Conference.*

Let me say that what I think should be done or let me first say what I think the embarrassment will be, and that is what I referred to in making Alaska a showcase. We have an opportunity, because our simplistic involvement in the whole field of communications is very rudimentary. We have had no increase of terrestrial facilities to speak of in comparison to the other parts of the Nation. We could just leapfrog into this new technology and utilize it.

Now, if the United States does not choose, through one device or another, to do this in Alaska, we will have ourselves in the unfortunate position that Canada will have this in 3 years, and India will also have it in 3 years, and so will Europe.

So we will sit back and note that, well, Canada is very advanced in this field and maybe we ought to do something about it in the United States. What I am suggesting is that we could do it in Alaska and then of course you gentlemen could point to Alaska and say, well, why don't we have the same thing as Alaska has?

And this, I would hope, would be the catalyst that would get the United States off its duff and doing something in this field, be it at the insistence of the administration, be it at the imaginative leadership

level of COMSAT, or be it at the generosity of NASA or be it from the leadership of ourselves.

It could come from anywhere to pinpoint a specific program. I would say if we could get some funding, some approval, some backing for what we are trying to pursue in Alaska, I think we could move ahead and demonstrate what these broad benefits could do.

Mr. MOSHER. Do you see action, initiative and action indicated in the Congress? Is that where this should start?

Senator GRAVEL. I certainly feel that if the White House does not, if the administration does not come forward with a proposal, then somebody will have to initiate something. In my humble way, I have introduced very minor legislation affecting the area, and am waiting patiently on the administration. If nothing is forthcoming I will use my humble resources and attempt to broaden legislation, to attack the problem.

Mr. MOSHER. You have introduced legislation on the Senate side?

Senator GRAVEL. Yes.

Mr. MOSHER. There haven't been any hearings.

Senator GRAVEL. Not yet. And, of course, the lid has been put on, because we are all breathlessly waiting and hanging by our eyelashes for the administration to move.

Mr. MOSHER. Do you have any scuttlebutt as to when the White House is going to move?

Senator GRAVEL. No, the only scuttlebutt is placed in testimony here and that was October 1, 1969.

Mr. MOSHER. You have been in touch with the White House since then?

Senator GRAVEL. Oh, yes. In fact, we would like to live over there, work right with them.

Mr. MOSHER. That is the most interesting announcement of candidacy I have ever heard.

Senator GRAVEL. Freudian slip of the tongue. What I mean is I'd settle for a room next to Dr. Whitehead over there.

Mr. MOSHER. On page 12 you talked about the India project, and I notice that it is entitled an experimental project. How much emphasis is there on that word "experiment"? Is this in fact perhaps an experiment that is moving, from which we can learn about what we need to do for domestic uses in the country?

In other words, is this a very positive step from which we will begin to accomplish exactly what you are talking about?

Senator GRAVEL. No question. I think any step is a positive step. I think it is of great benefit to India. In fact I see the satellite communications as the only way for India to solve its gigantic population problem.

However, I think the use of the word "experiment" in the title of the agreement is merely a convenient statement. It is experiment for us, but it is real for them. And they are going right at it. Now, if they want to have some experiments in Alaska, and I don't begrudge them doing it in India, I would hope that we could go on with some experimentation in Alaska and we would provide all of the benefits that I have described.

Mr. MOSHER. You are convinced this experiment in India is going to be a success?

Senator GRAVEL. And I am not only convinced, sir, but I am convinced that any responsible technical authority in the Nation knows it will be a success.

Mr. MOSHER. And it isn't an experiment to the extent that it will reveal a lot of things that we need to learn before we adopt it in this country? And therefore, perhaps it is a good reason to wait?

Senator GRAVEL. Well, I would say not. I would say that if you want to do an experiment, maybe we should do it in the small area, that is not going to affect a great deal, which won't cost a great deal in relationship to the Nation, and that small area could be people who are taxpaying Americans, and that could be Alaskans.

We only have 270,000 people. We have a small case. It could be a beautiful experiment. And then we could learn everything we want to there and then superimpose this over the Nation. Now, again I want to emphasize that I am not begrudging India this thing. I think we are doing a very fine and charitable thing, but I think we can do fine and charitable things concurrently for our own Nation and I submit that it is easier to do it for India because, in my opinion, India doesn't have the vested conflicting interests which have impeded the development that should have taken place.

Mr. MOSHER. Mr. Chairman, I suggest that on the bottom of page 5, incidental to his other remarks, the Senator makes a case for our emphasis and interest in the earth resources satellites. We should note that in passing.

Senator GRAVEL. Very much so.

Mr. MOSHER. I have no further questions, Mr. Chairman.

Mr. KARTH. What my colleague from Ohio just said, Senator, is that this committee, for a number of years now, has been attempting to encourage the executive branch of the Government to give more attention to all applications satellite systems, including communications, of course, but more specifically earth resources survey systems, where there has been very little progress. The kind of aggressiveness we recommend has not really been forthcoming. NASA continues to say that they are moving at a well-thought-out pace, but it does lack the imagination that we think a program like this ought to have.

Mr. Downing.

Mr. DOWNING. Thank you, Mr. Chairman.

Senator, that was most interesting, and well done.

Senator GRAVEL. Thank you.

Mr. DOWNING. From previous testimony from NASA officials, I had the idea that the Alaskan experiment was further down the trail than you indicated. What is its present status?

Senator GRAVEL. I don't wish to embarrass anybody as to how far the Alaskan experiment is down the trail, but we are building satellites, COMSAT is building a satellite station in Talkeetna which will provide in essence external telephonic communications from two of the major cities, and will relieve some of the burden on telephonic communications to points outside of the State, and in addition, maybe we can view an occasional funeral or occasional sports event on the international scene.

That is going to be the sum total of our initial satellite improvement. That answers the question. Additionally, we have been able to convince RCA beneficially into volunteering to loan some of their equip-

ment, let us borrow it, to put it into this pilot program, and COMSAT has indicated its willingness to also put up some equipment into this pilot program, so we have got some borrowed equipment.

We are trying to get the military to transport it to Seattle, and from there we are going to try and get some private companies to then transport it to Alaska. I plan on offering to the State legislature a proposal of some money that they could put up, and maybe pursue this without waiting on the beneficence of Congress, because it may take too much time.

Because I think if we could get a 9-month program operating now we could develop estimates of permanent infrastructural cost, make projections and then know exactly what we have to go by, and if we have to buy or lease a satellite for Alaska, and I think the cost will show that it would be a viably economic thing, I would recommend that Alaska go do it and if there is no Federal program in existence, I would still recommend that Alaska go do it, because I think the benefits to us would be just incalculable.

Mr. DOWNING. What is the role of NASA in the Alaskan experiment?

Senator GRAVEL. Other than putting up the launch, nothing at this point. We would be restricted on the ground. Now, in space, we would be borrowing ATS-1, which now has no particular use presently, and has a very short life expectancy, approximately another year, to a year and a half.

We don't really know how long it will last. But we have heard some scuttlebutt that they may be putting it to some other uses and as we continue to delay we may be trapped in a situation where we may wind up with the equipment on the ground but nothing to plug it into in space.

Mr. DOWNING. I gathered from the NASA testimony yesterday that they were pretty much in favor of this project.

Senator GRAVEL. They have indicated to us, very much in favor of it. So I can't fault them in that regard. But when you are asking for a progress report, and I am giving it to you, it is held together by a little bit of spit and a little bit of glue all the way across. I don't think we can take great pride that the Federal Establishment is pursuing aggressively anything of great value.

Mr. KARTH. Will the gentleman yield?

Mr. DOWNING. Yes, sir.

Mr. KARTH. Senator, what is the status of negotiations between Alaska and NASA for the use of ATS-1?

Senator GRAVEL. NASA has agreed unofficially with my office that they would let us use for the 9-month period, the experiment period, ATS-1. That is the status of it from their point of view.

Mr. KARTH. Are you saying those negotiations have in effect been consummated?

Senator GRAVEL. No, there is nothing yet formalized, because we don't have any equipment up there to plug into it.

Mr. KARTH. I understand. But as soon as the ground paraphernalia is in.

Senator GRAVEL. Once it is in position and ready to plug in, we are led to believe that that is——

Mr. KARTH. Then NASA has agreed to plug ATS-1 in for whatever purposes Alaska intends to experiment with it for, is that right?

Senator GRAVEL. Right. Exactly. But imagine the embarrassment if we get this equipment in place ready to function and all of a sudden they develop another use for it and have to give us a Dear John letter. That is quite possible.

Mr. KARTH. What you are saying, then, is that whatever negotiations have evolved as a result of your interest and other interests of people from Alaska, and which thereafter has led to talks with NASA, informal or otherwise, you really don't have any solid agreement?

Senator GRAVEL. That is correct.

Mr. KARTH. And you may well make all kinds of plans and reach a point where you could plug in, but at that moment the satellite might not be there for your use. Is that what you are saying?

Senator GRAVEL. Yes. Although, I think the agreement is getting more solid all the time as we are talking.

Mr. KARTH. I beg your pardon?

Senator GRAVEL. I think the agreement is getting more solid all the time.

Mr. KARTH. We would like to help solidify it a little bit.

Senator GRAVEL. You are helping right now, sir.

Mr. KARTH. I would just like to get for the record, though, the status of the negotiations or the status of the agreement, if there really be one.

Senator GRAVEL. As I have reported and as you have just interpreted; they are as you just interpreted.

Mr. KARTH. When do you expect that these negotiations ought to be formalized, so that we have more than just a gentleman's understanding about what and when Alaska might be able to use ATS-1?

Senator GRAVEL. NASA naturally had been waiting on the Governor of Alaska to make a formal request of NASA. We had made informal requests. They had agreed to our requests. The Governor made a formal request last month.

And NASA is now analyzing and making a review of this formal request, from a technical point of view. But you see, the request, and I think they would have some legitimacy, the request is really up here when we don't have anything on the ground to plug in.

Now, when we have a verbal—do we have anything in writing from RCA? Yes. We have a written agreement with RCA, not a formalized signed agreement, but a letter of agreement, stating that they will lend us their equipment, which is at Guam, and moving that equipment will cost around $18,000 which we are chasing down to move the equipment from Guam to Seattle.

But I confess that we don't have the transportation tied down yet to move it from Seattle to Alaska.

Mr. KARTH. I am not sure, after having listened to your answer to my question, that NASA is all to blame, really.

Senator GRAVEL. No, they are not. And I don't want to give that inference. But I think it would be conceivable that NASA could find another use for this ATS-1, while we are trying in a sense to glue the rest of the program together. And then of course we would have the ground facilities in place to operate, and then we would be stuck without a satellite, so our experiment would come to naught.

So I think at this point in time the success of this program, which has been initiated, incidentally, by myself, and this is of course the

reason I don't have the strength, as you gentlemen can well appreciate, of an administration saying that here is a plan, we are going to do it.

This was a plan we came up with. We had to talk the State administration into doing it. We had to talk various segments into going along with this experimentation. Now, I am not faulting NASA one bit in this regard and I am very happy that they can find a use for this ATS–1, which is not being used for anything at the present time.

Mr. KARTH. Well, I don't intend to suggest, Senator, that this committee is a protector of the agency. If you knew something about the record of this subcommittee, and I am sure you do, you know that is not necessarily true. When they are right we praise them and when they are wrong we don't make much of an effort to do that.

I can well understand why NASA may be somewhat hesitant to dedicate the use of ATS–1, at this point, when they really don't know whether or not Alaska and the State administration up there is going to effectuate their part of the bargain by bringing into being the land-based facilities and other paraphernalia necessary to communicate with the satellite and make it operative.

I can understand why they might be hesitant to dedicate its future use when they don't have any guarantees that Alaska might follow through in their half of the bargain. And so I am sure that as the State moves forward, Senator, and hopefully the congressional delegation here, not representing the great State of Alaska, can be of assistance to those of you who do represent the State of Alaska in the Congress, in suggesting to the State administration in Alaska that they be more aggressive in formalizing their plans, and making some solid commitments to carry out their end of it, so that NASA can realistically commit the use of ATS–1 to your State.

Senator GRAVEL. If I could only add to that, I agree with you, and that is the reason why we haven't pushed. This is the first time that I think we have talked of it publicly, outside of the confines of the Alaskan press. We are only talking, of course, about 5 or 6 hours of utilization of this ATS–1, even when we are in full operation.

Mr. KARTH. Mr. Downing.

Mr. DOWNING. As I understand it, you contemplate using private industry, RCA, in the establishment of the ground facilities?

Senator GRAVEL. We are just borrowing. It is a ground station. It is being moved from another locale to Alaska and we are just borrowing it for the purpose of this experimentation.

Mr. DOWNING. Is that equipment sufficient for the program?

Senator GRAVEL. To go ahead with the test. That equipment will be placed in one community and, like I say, if we have another station from COMSAT, that will serve another community.

Then we have to chase down the equipment for two other communities. But we can start once we have it for the first two communities. We will use the satellite and start educational programs and the like, and develop teacher experience.

Mr. DOWNING. Do you nail down the ground facilities, and NASA would agree to furnish the ATS–1, what other authority would you need to go ahead?

Senator GRAVEL. We wouldn't need but one more authority. We would need some operational moneys and this is a budget we are

putting together now to submit to the State legislature, since I see no way of rapidly getting some funds to pursue this goal.

Mr. DOWNING. To have the operating funds provided by the Alaska State government?

Senator GRAVEL. Right. I can't see any other way to get funds with any immediacy.

Mr. DOWNING. If you did that, what other national approval would you need?

Senator GRAVEL. Only one more after NASA. NASA would be one, and I feel that unless they developed another use for this ATS–1, that they would give it to us and that would be important to what we would need.

Mr. DOWNING. It sounds like you are ready to go ahead.

Senator GRAVEL. We would also need FCC approval.

Mr. MOSHER. Will the gentleman yield?

What considerations have to be granted to RCA to make them part of this deal?

Senator GRAVEL. We have offered none and intend to give none. We think that the press that they will have—see, they are the successful parties on the purchase of the ACS system, and the fact that they would benefit by partaking of a satellite operation would give them some expertise themselves.

Mr. MOSHER. They would be in on the ground floor.

Senator GRAVEL. Right.

Mr. MOSHER. That is to their advantage.

Senator GRAVEL. Yes. And I think there is a general feeling, and it is a slight departure from the initial question, but since we have been talking of this, we have been meeting with several areas of industry, in fact they have even prepared proposals with respect to Alaska, and I think the fact that the priority of our space applications are now coming into consideration, that many of the industrial areas are realizing that in order to stay in business they are going to have to move to a new area and new area may well be communications.

Mr. MOSHER. Will the gentleman yield further?

This arrangement with RCA has been consummated? I mean completely agreed to?

Senator GRAVEL. Yes.

Mr. MOSHER. And what is the time limit on this?

Senator GRAVEL. We have put no time limits, since we found it better from our tactical position to just use our best efforts.

Mr. MOSHER. So RCA loans this equipment to the State of Alaska for an indefinite period of time, without any other consideration?

Senator GRAVEL. Right. And we hope to have it on board ship by mid-January. Now, obviously, if the program falters seriously, and the rest doesn't fall in line, they can withdraw their offer and say, well, gentlemen, we were willing to help you but you don't seem to be getting off the ground so we found another use for this.

Mr. MOSHER. Has this equipment been in operation in Guam for a long time? And why isn't it continuing in use there?

Senator GRAVEL. It has been in use there, and it has been obsoleted because they are using other equipment and it has been packed in crates for about 4 months. So from their point of view, they are not unplugging the item and putting it somewhere else, to the detriment

of one place. They just have it on hand and they are just letting us use it.

Mr. MOSHER. You used the word "obsolete." It is obsolete but not too obsolete for Alaska?

Senator GRAVEL. No, not for our experimentation purposes.

The COMSAT station, which is in the Philippines, has been in storage for almost 2 years The RCA station has been 4 months in storage.

Mr. KARTH. Would you identify for the record your administrative assistant?

Senator GRAVEL. Mr. Bernard Poirier, of my staff, my Special Assistant for Satellite Communications.

Mr. KARTH. Thank you.

Senator GRAVEL. Which will give you some indication of the importance I place on satellite communications.

Mr. DOWNING. I admire the initiative of you and the other people who brought this along this far. It would appear to me that you are in a position to go ahead, regardless of what the administration does, or what Congress does. Certainly this committee has been pushing NASA for the better space applications program, and this would be a prime example of a good program, in my judgment.

What is to stop you from going right ahead under your own impetus right now?

Senator GRAVEL. Well, nothing, except the good will that we create, or let's say the fear that I might be too outspoken, or it is just a promotional job that we are doing, essentially, and as you can well see, there is nothing really nailed down anywhere.

We are just pushing at all sides, trying to keep everybody involved, and keep moving along with really the very simple glue of enlightened self-interest.

Mr. KARTH. If the gentleman would yield and the Senator would permit, I think that you have got to get FCC approval of some kind before you can proceed.

Senator GRAVEL. Yes.

Mr. KARTH. Irrespective of your own desires. Now, if you are a foreign country you wouldn't have to wait.

Senator GRAVEL. We realize that.

Mr. KARTH. I suppose if you seceded from the Union for a few days, and initiated a program, we might even be glad to take you back, Senator, as the 50th State again. That is a possibility. But the fact of the matter is you do need FCC approval to proceed; do you not?

Senator GRAVEL. This is correct.

Mr. MOSHER. Will the gentleman yield? Has the State of Alaska formally applied for FCC approval?

Senator GRAVEL. We have gone through the University of Wisconsin for an application of satellite use for a radio station in Bethel. Let me tell this story, because I think it ties into the total effort. My position in Alaska was under some attack from the point of view of credibility, because many of the commercial television interests were very frightened of the cost involved in satellites.

One of COMSAT's officials had stated the extreme cost, using figures of $100 million, what it would cost for Alaskans, so there was a feeling abroad in Alaska, well, Senator Gravel probably doesn't know

too much about this and we should be real leery of pursuing any experimental program.

Well, we were able to talk a private foundation into donating a ground radio station for the city of Bethel, which has no radio at all. There are 15,000 to 20,000 people in that whole area of the State. All they get is a weak signal from another part of the State which only has one radio station and that is a regional station, so this area has no newspaper, radio, television, nothing.

And we were fortunate to get a foundation to donate about $10,000 for the ground stations. And we are to use the public broadcasting facilities at the University of Alaska in Fairbanks to pipe material to them through the satellite, and this application was made through the University of Wisconsin, and it was granted to the State in 1 day.

So based upon this type of experience to our efforts, we realize that we have to get approval from FCC, but I feel at the proper time if we can keep the rest glued together that they will come along also with the proper permission.

Mr. MOSHER. But Alaska has not yet made an application?

Senator GRAVEL. No, it has not. The Governor has now written a letter. It has just made that move. Now, I am frank to say that I have had differences of opinion with the Governor of Alaska, and many times have charged the State has not been moving aggressively on this program as I would like but they are moving; but it is not an ideal situation, and I think you can see that the whole situation is not an ideal situation. We are doing as best we can. But mind you, if we are successful in getting this experimentation, it will be the only one in the United States.

Mr. MOSHER. And you are confident that the costs that you have mentioned a moment ago are exaggerated?

Senator GRAVEL. The costs that were referred to by COMSAT in Alaska, yes. I don't think it will cost $100 million.

Mr. KARTH. What were those costs?

Senator GRAVEL. $100 million.

Mr. KARTH. Is that what the State of Alaska would probably be required to put up?

Senator GRAVEL. I don't think it was defined in that regard. I think the statement was made in very general context, and that is that it could cost the State of Alaska on the outside $100 million to have satellite communications.

Mr. KARTH. This is for a completely operative system; is that right?

Senator GRAVEL. I would imagine so.

Mr. KARTH. With all that oil money you have up there, Senator, you could spend a little of it.

Senator GRAVEL. This is what I am trying to sell the legislature on, to use some of that income.

Mr. KARTH. You are better off than the Federal Government.

Senator GRAVEL. Well, I wouldn't say we are better off than the Federal Government. We are very fortunate that we are blessed.

Mr. DOWNING. It appears to me that you all are wrapping the package up.

Senator GRAVEL. I wouldn't want to mislead you. I think you are doing as much to wrap up the package in the short hour this morning as I have been doing over the last few months, because I think

that people can gather the tenor of the feeling of this body and this is the first body of Congress that we have with which we have had a forum.

So I think you realize how important that is.

Mr. DOWNING. I see your point. I think it is a great project. I would like to see it go.

Senator GRAVEL. Thank you.

Mr. DOWNING. Thank you very much.

Mr. KARTH. Mr. Pettis.

Mr. PETTIS. Mr. Chairman. Senator Gravel, I would like to go beyond the scope of your presentation just a little bit, the technology and all of that, to talk for just a few moments about this experiment in terms of programs. You have probably given a great deal of thought to this, in the light of the fact that Alaska does have unique characteristics which I think are not generally applicable elsewhere in the United States, but which resemble those of countries like India. We have heard some testimony as to what would be used in a country like India. Would you mind verbalizing for a few moments your thoughts on the use of this technology as far as the programing to the people?

You said something like 300,000 people, some in remote areas.

Senator GRAVEL. Let me just really dream a little bit with you, and it is not pie in the sky, because these things are closer than we realize if we wish to really make an effort to go get them.

Right now, and we have a great controversy in the United States concerning news, by the Vice President. It is unfortunate in that regard, but I think if we realize that what we are experiencing in the use today of the media is only a small fraction of what we could experience, and what we have done is placed all of this experience under the profit system.

Interestingly enough, all of the governments that are moving ahead of us right now are doing it with government, not necessarily through the profit motive. Now, many times I think we ask too much of commercial television. We ask it to pack along all these other things which it can't do.

But we substantially have no cultural television in this country, and that could be as broad a spectrum of entertainment as commercial television. We have no educational television to speak of, and that could be of an even broader spectrum, because you could have such a situation as when a person who wanted to take a course in carpentry, could take a little book that could inform him that at Tuesday night at 8 he can tune into this channel, and he would sit there and watch demonstrations on carpentry.

He turns the knobs on his television set, sits at home with his can of beer and popcorn and learns carpentry.

You could have a situation where a doctor in the operating room of a hospital, in a remote area, could pick up the telephone, call the Lister Hill Center for Biomedical Communications. The call would be transferred to the Medical Center of the University of Vermont who would give some information about a diagnosis for his patient. They would put that in the computer, and immediately give him the various possibilities and diagnostic assistance. Then he could make a determination if he has to operate.

He would pick the phone back up and say, Do you have anything on this type of an operation? He could turn on his television set in the operating room and watch a film clip of an identical operation and then turn around and perform the operation.

Now, if that isn't service, through the utilization of new technology, I don't know what is and that is just a beginning of what could be done. So when we talk about benefits and new priorities for the people and we talk about the problem of sustaining a large industrial infrastructure, and we have lost our horizons or our desire to go rapidly to Mars, I would hope that we would redirect our attention and bring about broad benefits to all of the people.

And I think it could be done through communications. Now, that is just some of my dreaming.

Mr. MOSHER. Will the gentleman yield?

Mr. PETTIS. I yield.

Mr. MOSHER. I am inclined to be a critic of our present television fare, but you say, "Those countries that are far ahead of us." What are those countries?

Senator GRAVEL. India. Well, they are moving far ahead of us. Well, Russia right now has a domestic satellite system, and so also the Eastern European countries.

Mr. MOSHER. I mean in their programing.

Senator GRAVEL. I think Canada, the University of Toronto, and the Province of Ontario, which has been very kind to us and is willing to offer us their program material, at essentially no cost other than artists' fees, is far ahead of anybody in the world.

I think Japan, through its system in programing, is far, far ahead. We are able to send Mr. Poirier to Japan to spend the week with them. Again, not through the good fortune of having some Government money at hand. We had university funds to send him because I personally don't have the budget to do this.

Those are two countries, as example, that are far ahead of us.

Mr. MOSHER. Their general television programing is far superior to ours? In what terms? Cultural terms, you mean?

Senator GRAVEL. Educational terms and cultural terms.

Mr. PETTIS. If the gentleman will yield, I would just like to observe that there are other countries; take England, for example, which has one channel at least open to the public of material which is devoid of some of the commercialism we have in this country.

That is a pretty good example of what you are talking about.

Senator GRAVEL. But we could have both. We could permit the commercial sector to occupy that portion of the spectrum, and then move out into cultural and into educational television. But obviously we are going to have to talk about dedicated funds to budget for this and not put it on the back of the profit system, because the profit system can't carry it.

Mr. MOSHER. Are you aware of the Forsythe Saga?

Senator GRAVEL. No.

Mr. MOSHER. The program everyone seems to be watching, and not on commercial television, but on educational television here in this country.

Senator GRAVEL. And it is unfortunate that this year the budget has been cut by over 50 percent as far as public broadcasting is con-

cerned. So rather than imaginatively moving out in this area we are retrenching in a drastic manner and that is the reason why I wait with bated breath to see what this broad communications plan is that will come out of the administration, because if they are cutting back they must be getting ready for a tremendous onslaught.

Mr. PETTIS. I would like to make this observation in closing. We have an experimental television station in my district which is completely educational. This just saturates this whole area of southern California, and thousands of people have gotten adapters for their sets in order to get into this particular kind of programing.

I am convinced that the public all over the world, and including the United States, is just ready for educational and cultural material, which it is not now getting.

Senator GRAVEL. How we could broaden our horizons is just unbelievable. And when you think about it for any period of time, it becomes shameful that we are not doing it with any aggressiveness.

Mr. PETTIS. Thank you very much. I thank the Senator for his presentation this morning.

Senator GRAVEL. Thank you, sir.

Mr. KARTH. Mr. Symington.

Mr. SYMINGTON. Thank you, Mr. Chairman.

Senator, this has truly been a fascinating presentation. I know it has answered quite a few questions and it has raised innumerable questions. I would only correct you in one regard. You said that you might be guilty of mindless dreaming in projecting these possibilities. I think that our society is already engaged in that activity, and if we could trade the mindless dreams that we are already engaged in for some of the thoughts that you have expressed, we would be doing better.

The thing that intrigues me most of all is the fact that you have actually detailed how satellites could offset potential disasters and open potential opportunity which are truly of continental proportions, and in terms of the size of your great State, and that being so, realizing that the American taxpayer is involved in a lot of expenses that he doesn't understand, it occurs to me to move ahead in these areas in our own State, and throughout this country and as part of our foreign-aid program around the world, would be to get far more for the dollars we spend, just as taxpayers paying for public activities.

Yesterday we learned from Dr. Marsten, who is director of communications programs of NASA, that we have spent 1 percent of NASA's budget in communications relative to the amount that we have spent in the effort to get men to the moon, over the past 10 years.

Something like $25 billion to get to the moon, and $250 million to use this kind of technology to improve communications to serve mankind. You have stated at the close of your paper that a great deal of reexamination of our priorities is taking place. Wouldn't you agree that 1 percent for communications and 99 percent for the moon is an imbalance?

Senator GRAVEL. A very, very sad imbalance.

Mr. SYMINGTON. We are proud to have the technology and the men and the courage that took us to the moon, and we realize the prestige that, in one sense, this brings to the country; but I do feel that the Nation is at the threshold of a new awareness of what its mission

is, and in another subcommittee of this general committee we have just concluded hearings on the assessment of technology.

That is Mr. Daddario's committee. There was testimony before that committee by a number of professors suggesting as you have suggested that the simple profit system of inducing programing that is beneficial to individuals, citizens, is not enough, and in some fashion we ought to be able to gear our resources and project them for the benefit of mankind, in a supplementary way to what people are willing to pay for commercial broadcasts.

You have given an extra dimension to that, when you have suggested that if we really went to work, you could actually get a spot film to tell you what to do at a given moment, in any field, to avert danger. I just want to add my congratulations to you for the statement you have made.

One other question is, when did Alaska first, that you know of, make its request to the Government? This question has been approached in different ways here this morning, but I am interested in knowing, inasmuch as you convey a certain impatience in your statement here, when was the request first made?

Senator GRAVEL. The experimental program was announced 4 days before the Apollo shot. And the State of Alaska has since made a written request to NASA. But we had unofficial approval from NASA very shortly after the request. When they saw what we were trying to do they thought it was a fine utilization of ATS-1.

But I think the formal request from the Governor was about a month ago. Well, later than that. I was talking about Apollo 11, last July. So we have laid out this experimental program last July, hoping to get it implemented in September.

Of course, I now realize that that was an impossibility. But now what we are trying to do is hoping to get it implemented the following school term or later.

Mr. SYMINGTON. The negotiations with India have gone on for some time?

Senator GRAVEL. Oh, yes. We are aware of the Indian situation, and there is no question that I could have taken it to the floor of the Senate and depreciated the generosity in the face of the difficulties I was having. But I didn't think, and I have stated here again and again that I don't begrudge India getting this satellite.

I have talked about it with Mrs. Gandhi. In fact, when I met her last August, that is all we talked about. And I am convinced that this is the only way she is going to solve her population problems, because they don't have religious impediments but they have a knowledge impediment, and the only way you can communicate, the only way you can solve this knowledge impediment is through communications.

Mr. PETTIS. Will the gentleman yield for a question on that point? How long would it take to get this going if you had the green light tomorrow morning at 8 a.m.?

Senator GRAVEL. Well, it is not so much the green light. We would need some green paper. And that is as fast as we could spend it. Let's put it that way.

Mr. MOSHER. Will the gentleman yield?

You indicated, didn't you, that your negotiations have moved much more rapidly than the Indian negotiations? In fact you have received almost instant encouragement from NASA.

Senator GRAVEL. Let's realize that we have received permission to use a satellite which is not being used by anybody. Now, India has received a brand new satellite program.

Mr. MOSHER. That is what you asked for.

Senator GRAVEL. Granted. But India has received $40 million, you know. That is what they are going to get out of it.

Mr. MOSHER. Is the basic thing you are getting around to a request to Congress for money?

Senator GRAVEL. No, I haven't requested any money of this committee.

Mr. MOSHER. Where is the green stuff coming from?

Senator GRAVEL. Right now if we had the money to transport RCA and COMSAT equipment to Alaska right now we could begin setting it up.

Mr. PETTIS. That was the thrust of my question.

Senator GRAVEL. Exactly. Say if there is some place in NASA's budget that you people know if, from your experience, that they could pay for the transportation of this equipment immediately, then we could immediately start working.

Mr. MOSHER. Isn't Alaska far more capable of this financially than NASA?

Senator GRAVEL. Not necessarily. If you are talking about a national experiment, the benefit of which will accrue nationally, as will the Indian experiment which is what you have inferred before, then obviously the burden should be borne by the Nation and not just by Alaska.

But since I have found no way to find this money, I am going to make a proposal to the State legislature, asking them to do something.

Mr. PETTIS. Thank you.

Mr. SYMINGTON. We were told yesterday that India had the capacity to produce 300 television sets a year. And I wondered at the time if that was the kind of capability that would make a program of this character worthwhile for India.

And then it was suggested that, well, they will use some foreign exchange to buy the necessary equipment from the outside world. Alaska doesn't suffer from that kind of problem.

Mr. Chairman, with your permission I would like to address a question to the staff, Mr. Hammill, if I may, because yesterday we were told that India picked up most of the local costs of some 5,000 receiving stations, and that figure, it seemed to me, was something like $15 million.

Mr. HAMMILL. Yes, that is correct.

Mr. SYMINGTON. What was it costing us to get that satellite assistance to them; $40 million?

Mr. HAMMILL. Well, the ATS-F and ATS-G project includes two satellites; it is the first satellite, ATS-F, that will be used for the Indian experiment. The total project is currently estimated to cost NASA $140 million.

Mr. SYMINGTON. That is the Indian project?

Mr. HAMMILL. Well, only one of the two satellites will be used for the Indian experiment. Now, Senator Gravel used the figure of $40 million to describe the cost of designing, fabricating, and launching the ATS-F, the first of the two.

Senator GRAVEL. Right. If you are trying to apportion it to one place, the figures I have, about $44 million. Incidentally, the Germans are building a plant in India to mass produce television sets. So that they are building their industrial infrastructure to meet their needs.

Mr. SYMINGTON. Well, my thought is that for us to neglect an opportunity at home to conduct the same kind of experiment, with an infrastructure and a capability and an understanding infinitely larger than that we could expect in another culture in the East, which would generate funds for providing assistance to less fortunate people, would seem to me to be the more orderly way to proceed.

In any event, I would think that the earliest practicable time that we can go forward with the Alaskan demonstration would be in our best interests.

Senator GRAVEL. Thank you.

Mr. SYMINGTON. Thank you.

Mr. KARTH. Thank you very much, Senator.

Unfortunately, we still have two witnesses. Our distinguished colleague, Congressman Pollock, is going to testify right behind you.

Senator GRAVEL. Mr. Chairman, I thank you and the committee very, very much. I think you have done more than anyone to help.

Mr. KARTH. There is only one question on which I would like to have some clarification for the record. This committee has prided itself on keeping a very careful eye on dollar expenditures, and for some reason the $4 million that you mentioned on page 11, which has apparently been funded by the taxpayers, but which should have, according to your statement, been funded by and paid for by COMSAT, and which was not, is one of those things that apparently this committee has missed.

I wonder if you could identify specifically what this $4 million is that the taxpayer footed the bill for, and should not have?

Senator GRAVEL. The cost of launches are projected ahead, when the launch is agreed to, and then when the launch actually takes place; then there is a determination of what it cost, and then it is turned around and billed.

Mr. KARTH. Yes.

Senator GRAVEL. Subsequently, the Air Force has had some costs that it attributed to the launch, which it informed NASA of, and NASA in discussions, what have you, decided not to bill it to COMSAT because this would have occurred at the same time that COMSAT was negotiating the American position in INTELSAT in the spring and late winter of this year.

So in order to sort of not require other people to pony up, because this would have placed the dilemma upon the INTELSAT organization to come up with the money, and INTELSAT organization had already negotiated the contracts with the users, so they would have had to go back and renegotiate the contracts with the users, based upon a new cost figure.

So they either had that choice, or to turn around and say, we will absorb it or we will charge it to the new guys with the next launches. So rather than pursue all these gyrations it was felt that we would just put a lot of oil over the waters and sort of forget the cost.

Mr. KARTH. So what you are saying, really, is that our Government decided to expedite further international communications via satel-

lite. We were willing to pick up an additional $4 million of costs. But at the same time, we are unwilling to pick up any portion of the cost that Alaska might have?

Senator GRAVEL. Right. You could make that comparison. But I think you could also make the valid comparison that you are not dealing with social use, you are dealing with private uses in this case, which turns around and sells these services to people like yourself and myself, who make long-distance calls.

There is a little difference there between that use and the use of a satellite for India, which is going to primarily prosecute educational factors. So I think there is a determination that is subjectively made somewhere in the echelons of Government, and I just bring that out in my thinking, as an approach in the face of the approach of these foreign interests at the same time trying to dilute substantially our interest in the international field.

Mr. KARTH. One final question. Has the Alaska delegation or the State administration made any request of NASA to fund the transportation costs of this equipment?

Senator GRAVEL. No.

Mr. KARTH. Inasmuch as it is a space application experiment?

Senator GRAVEL. The State hasn't, and we are trying to handle it. We were happy to get that facet of it. We have not placed a formal request. Commensurately, they have not volunteered.

Mr. KARTH. Any further questions?

Thank you very much, Senator.

Senator GRAVEL. Thank you, Mr. Chairman.

Mr. KARTH. Very enlightening testimony.

I am very happy to have our colleague, Congressman Pollock of Alaska, as the next witness. Howard, will you proceed with your statement at this time, please?

## STATEMENT OF HOWARD POLLOCK, U.S. HOUSE OF REPRESENTATIVES (AT LARGE), ALASKA

Mr. POLLOCK. Well, Mr. Chairman, and my good friends of the Space Science and Applications Subcommittee, I am very privileged to be before you. I don't think I have ever faced a committee where I have more close friends in the Congress.

I am delighted to be here and I appreciate the opportunity to come before you this morning to present some of my thoughts on the U.S. communications satellite activity. I am particularly pleased by the emphasis you have chosen to give the communications needs of Alaska.

In your opening remarks yesterday morning, Mr. Chairman, you expressed your disappointment with the lengthy delay the American people have encountered in realizing the benefits of a domestic communications satellite. Mr. Chairman, speaking on behalf of the Alaskan people, I cannot concur more strongly.

It is with profound frustration and dismay that I have seen much of my efforts and those of my colleagues to improve Alaskan communications over the past years consumed by seemingly endless debate over inconsequential and diversionary issues.

You also indicated it was your hope for this series of hearings that we might be able to identify and clarify the issues which have impeded our rate of progress and deprived the U.S. taxpayer of an

earlier return on his investment in communication satellite technology. I hope to assist you in raising what I feel to be the issues.

I would like to examine my views, however, against the backdrop of the present Alaskan Communication System, and indeed, the needs of Alaska. What must be stressed at the outset is that because of the geographic separation of communities, the harsh climatic conditions, and the difficult terrain, communications in Alaska is particularly critical.

The State is presently served by a skeleton network comprised of the White Alice and Alaska Communications Systems, both of which are currently owned and operated by the USAF. These systems were planned and installed to meet the operational requirements of the military and the Federal Government in Alaska, although they also now relay all commercial longlines traffic.

The only excess capability built into the systems was that which could be justified by the estimated growth of the military requirements. It was not until after the system had been installed, in fact, that full consideration was given to having it carry commercial traffic.

It is important to realize that the communications plant within Alaska was not planned to meet the public needs. Furthermore, the system is totally incapable of responding to the mushrooming growth in commercial traffic now being experienced.

The bulk of the system equipment is 1950 vintage and highly obsolete, with there being only minimal system upgrading during the entire past decade. I might say in passing that that was because the impending sale of the Alaska Communications System to commercial interests, and the Air Force was simply not interested in upgrading the system.

The plant itself consists of a mix of high-frequency tropospheric scatter, VHF, and submarine cable systems, in addition to a very limited amount of conventional terrestrial land delay facilities. Because of the orientation of the system to the military and Government requirements, the existing facilities are loaded to full capacity in the major segments and have virtually no potential today for expansion.

The few local city exchanges in existence are then hooked to this White Alice-ACS backbone, and the entire Alaskan network is then tied into the lower 48 via an overland microwave route through Canada and a submarine cable to Seattle.

Turning from the long-lines telephone and telegraphy service to television, the sole TV broadcast service is located in Anchorage, Fairbanks, Juneau, Sitka and Ketchikan, with no interconnection capability on either the intra- or interstate level. This means that there is no live programing. Thus, all broadcast material is disseminated to Alaska, and from city to city within the State by postal delivery or equivalent. We have taped television. It is normally 2 weeks behind on any programing.

As a result of the system I have just described, where communications service is available, it is expensive and of a substantially poorer reliability and quality than we are familiar with in the lower 48. But the real impact of the shortcomings of the present system is not the expense or inconvenience of communications where it exists; it is the truly alarming situation confronting the bulk of Alaska's communities in which there is no intra-Alaska point-to-point communications at all.

There are approximately 2,100 communities within Alaska. Of these communities, 223 have a population of 100 people or greater. Yet 175 of these 223 major population centers—approximately 80 percent of the communities in Alaska with a population of 100 people or greater—have no existing facilities for communications other than by an occasional high-frequency radio installation. Just as significant, 90 percent of Alaska's native population lives in communities of 100 or less, and only 10 percent of these communities are even served by high-frequency radio—let alone local dial or toll service.

Thus you can see, the services required to meet the needs of the villages where most of the Alaskan natives live should include a full scope of telephone, telegraph, TV, and radio programing. These services are necessary in order to provide everything from normal commercial telephone and message service, to distribution of alarm or warning messages, to distress and emergency calls, to audio and visual educational services.

We recognize that the bulk of these services would not produce self-sustaining revenue. However, in good conscience, we cannot overlook these communications needs since they vitally affect the personal welfare, health, safety, and development of so many people.

Against this desperate need for improved communications much planning has been initiated and many positive steps have been taken. The Alaska Communications System is being sold to a commercial operator, with transfer scheduled for July 1 of next year. RCA, as the successful offeror in its bid to purchase the ACS, has proposed a very positive course of action for system improvement and modernization, although the State still awaits their proposal of a definitive long-term plan.

The uniqueness of the ACS is that an unprecedented opportunity exists to define and implement a logically conceived and well-ordered system. This can be done almost to the total disregard of the existing plant and equipment because of its obsolescence.

Understandably, the State of Alaska, and all interested parties, have looked to the most current technology as a means by which to rapidly and economically meet our existing and forecasted needs.

Based upon extensive study and review which I have conducted, and which has been conducted by other representatives of Alaska, and by leaders in Government communications and private industry, a long-sought-after solution has been universally agreed upon.

A synchronous satellite is the only means, in my humble estimation, by which the State of Alaska can achieve a communications system offering the scale and scope of services I have described, on as accelerated a basis as possible.

This is not to say the eventual system will be comprised only of the orbiting satellite and satellite-related ground equipment. What I am saying is that the final system, the optimum system, will most assuredly contain a communications satellite as an integral part, whether it be dedicated for Alaska's sole use, or shared in a broader system.

Resolution of the issue must further be in terms of the entire United States. Numerous satellite systems have been proposed for meeting Alaska's communication needs. The various design options have included plans for the use of an INTELSAT satellite, the Canadian Domestic Satellite System, a dedicated Alaskan satellite, and the U.S. domestic satellite.

Too frequently, however, I see the Alaskan requirements expressed only in terms of intra-State needs. The Alaskan satellite system must be fully integrated into the satellite system of the lower 48. This is necessary to provide a high-capacity link for communications to and from Alaska, and to permit greater economies to be achieved in the development and implementation of the satellite system.

It is, therefore, with a very real sense of personal regret that I say even though we in Alaska have enlisted the support of the FCC, COMSAT Corp., NASA, RCA, and others in our planning, we now appear only slightly closer to a positive decision being reached on a U.S. domestic satellite program than we were 2 or 3 years ago.

Fundamental to our decision to expand our Alaskan system, indeed the entire U.S. system, is a more clearly defined Government policy with respect to an overall satellite system.

The COMSAT Corp., common carriers, private industry, and State and local governmental agencies are stymied by the lack of a positive path to pursue. On the part of COMSAT and the carriers management within these private organizations is justifiably reluctant to make significant high-risk investment.

The matter of fact is, they do not know where we are going. Very simply, they are unable to see their way clear with respect to receiving a return on their investment, or even more basic, having any indication of the eventual disposition of the equipment or system in which they invest.

The net result of policy, thus far, has been to remove from the private sector of the economy the initiative and the incentive for undertaking development. This has stemmed in large part from delegating to inappropriate agencies the authority for guiding development, and, from the Government's failure to establish a single or ultimate focal point for communications planning.

The crux of the issue is the lack of policy regarding satellite system development, ownership, and operation responsibilities. In spite of the clarity of the problem, no one is certain precisely where within the Government the blame lies.

From the early 1960's to the present, the FCC has focused on the issue of a domestic satellite system. Twice, the Commission's activity has been held in abeyance: once, in favor of President Johnson's Rostow Task Force; the second and most recent time, by the Committee under Dr. C. T. Whitehead.

The extensive past and present study activity has been highly useful in establishing a framework for action. But the problem of defining a policy for system implementation and management, which I alluded to before, must be pursued with a much greater sense of urgency and priority.

I fully back the activity of the FCC in their attention to the ACS transfer, and the Alaskan INTELSAT station. Similarly, I appreciate the motivation behind and the need for the Rostow and the Whitehead committee investigations, but the time has come when we must come to grips with the situation.

We must now identify and define the institutional or administrative structure under which we will permit a system to be built. The time has come to merge for the common good the conflicting roles, charters and views of the many policy and regulatory organizations within our Government.

I grow increasingly impatient in having to remain on the sidelines, watching the issue being sidetracked at every step, while seeing the people of my State continue to be handicapped by the lack of adequate communications. Whenever the problem is approached, full assurance is given that the technical questions have all been answered. I tend to believe they have, but this makes it all the more disconcerting that our Government is unable to take the final step necessary to permit our extensive technology to be applied. I think this is a basic interest of this committee, and I want to commend the committee for holding these hearings to focus on the concept of space applications so far as communications is concerned.

If the U.S. taxpayer has failed to benefit fully from his investment in space, the blame belongs to the Government for not providing the direction and the opportunity.

If I might, Mr. Chairman, I would like to proceed and answer some of the questions that I think were raised by the previous witness and the questions propounded to him. I think there are some areas that were overlooked and need to be clarified.

Before I proceed with that, I would ask the good chairman if he would allow the record to be kept open for a reasonable period of time because there are other things that I feel I would like to submit to the committee, particularly in connection with the development of Alaskan communications, and the needs that I think this committee could serve in that regard.

Mr. KARTH. If there are no objections on the part of the committee, the Chair would ask that the record be held open for 5 days, if that would satisfy the witness——

Mr. POLLOCK. I think that would be fine.

Now, several things were discussed before. First, I think the specific answer to a question which was raised by my good friend, Mr. Mosher, is that the application by the State to NASA for the ATS experimental program which was alluded to before was on November 12, 1969.

This is not too long ago. There was one thing that was overlooked that I think must be made part of the record. Not only is the one RCA 42-foot relocatable earth station being provided, but COMSAT in fact has offered three of these relocatable earth stations for the purpose of the experiment. One is a 42-foot antenna, and two are 32-foot antennas.

The antenna from RCA is on the island of Guam. The COMSAT one, the 42-foot station, is in the Philippines. COMSAT has two that are now presently under construction in Massachusetts. The problem would be the expense in transporting all of these to Alaska for the purpose of the experiment.

It is a very sizable cost because these stations are big pieces of equipment, I think it would be an enormous burden on RCA, or on COMSAT, to expect them to not only provide absolutely free of charge these earth stations, and to in fact install them, free of charge, but to also pick up this additional cost of the transportation. I also feel that while the transportation problem has dragged, and we haven't got any answers on this, the Government and perhaps this committee could be very instrumental in helping us urge the Department of Defense, or MSTS, or any other Government agency to move the equipment. I

think it could be done not as special transportation, but along with the routine transportation of other facilities or equipment.

We have planes going to the Orient, to Southeast Asia, and coming back from these directions, day after day, and I think perhaps we could utilize some of this transportation."

I should point out that I have contacted Secretary of the Air Force Seamans in an attempt to explore the use of military airlift. All stations are presently packaged so as to be air transportable on USAF aircraft and the initial indication I have received from the USAF is that they may be able to provide Alaska with transportation support. If the USAF can offer us this help it will materially assist the State in reducing the overall program cost.

Mr. KARTH. Would the witness permit a question?

Mr. POLLOCK. Yes, sir.

Mr. KARTH. Have you established a realistic cost estimate for what it would take to transport these facilities?

Mr. POLLOCK. Yes, sir. Apparently by utilizing shipboard as the most economical means of transportation, the cost would be on the order of $50,000 per unit from Guam and from the Philippines to move them. I don't know what the cost would be for the two that are being manufactured now at the present time by COMSAT.

Mr. KARTH. Would you identify the other witness at the table with you for the record?

Mr. POLLOCK. Yes, sir. This is Mr. Carl Swartz, who is my special assistant for satellite communications.

Mr. KARTH. Thank you.

Mr. POLLOCK. He is my assistant for the communications needs generally for Alaska; he has been of substantial help to me and I am sure will be in the future.

As you can probably tell from the fact that we in the congressional delegation from Alaska, have been applying special emphasis to this need, we feel it to be one of our greatest needs in Alaska.

I am not sure I could honestly answer the earlier query of the committee as to the precise purpose of the ATS experiment in the full sense for Alaska except that we want very much to move into the satellite communications field. I think that we have a lot to do yet, in the area of programing, which my good friend Mr. Pettis discussed before. We have a lot of material to prepare and review for the experiment in which we intend using ATS-1.

I don't know whether ATS-1 will still be operational by the time we can put the pieces together. A great deal of attention and effort is required in such areas as transportation and financing, in addition to the actual programing.

I might tell the chairman that Mr. Pettis and I, during the upcoming Christmas recess of the Congress, will be traveling to Southeast Asia. I have made arrangements to talk with officials of the Australian Government on the programing they have for their radio communications system, in education between Sydney and the Outback, and where they have two-way radio communication.

It would appear to me that what we need, from an educational point of view in the State of Alaska, would be one-way video and two-way audio so that we could get the primary ETV signal into the classroom, plus offer classroom feedback to a central point for the purpose of students asking questions.

We plan to bring in the finest ETV lecturers and demonstrations available anywhere in the United States, or indeed in the world, to areas that could never conceivably have this kind of programing and training. We believe that a lot of this could be done in this interim period before we can get our total communications system in Alaska, by the use of this ATS experiment.

We propose to undertake the experiment in four locations in Alaska, but obviously we need to have this type of coverage ultimately on a much broader spectrum. One question was made, I think twice, about Alaska financing some of this. I think Alaska can finance some of it. We have to define the costs which are necessary.

One of the major concerns in the ATS experiment is that of the program cost. The total price for a 9-month to 1-year program has been estimated variously between $1.5 to $2.5 million. A sizable portion of this would have to be borne by the State which brings us to more carefully weigh the precise benefits. Considering the fact that programing basically would be provided only to the three communities in which the receive terminals would be installed, representing a combined population of less than 5,000 people, the cost is extremely high. Much of my present effort therefore has been concentrated on reducing these costs as well as attempting to shift more of the financial burden from the State.

Unfortunately, Mr. Chairman, everybody thinks that Alaska is extremely financially sound these days, but I would like to call the attention of the committee to the fact that every year since statehood we have had very substantial shortfalls in revenue to operate the day-to-day government of Alaska, and this has run into many millions of dollars.

It has been embarrassingly necessary each year to schedule some oil lease sales and use the revenues from the sales and from the bonus payments, in order to help finance the day-to-day operations of our government. Notwithstanding our recent very historic and very substantial sale, we anticipate shortfalls in revenue next year of some $50 million. This is a substantial amount for Alaska. We didn't want that sale, and we don't want any other ones, to be of the nature that we have to keep using the proceeds just to run the government.

There are things that we need for capital improvement, for education, for hospitals, for many, many things. That is just an aside, but we don't have a great deal of funds to spend indiscriminately.

Two other points I would like to make. Mr. Chairman. We talked before about progaming on the national level and bringing to Alaska educational television and instructional television and public programing, as we see other places. I think we do have an entity created in the country for this. We know it as the Corporation for Public Broadcasting.

Perhaps we haven't adequately funded it and perhaps the direction isn't right or perhaps it hasn't gone far enough yet. But I think that this is at least a right direction in this Congress which in recent years had the foresight to create such an entity.

But there is such a diversity of responsibilities and so many studies going off in different directions. I think it is time we tried to get some national policy and put all of this responsibility under one authority for the broadcasting concept.

To us it has been a total kind of frustration. If I may, one other point, and then I would be most happy to answer any question which might be propounded.

Today, as I alluded to in my testimony, and as you talked about it with Senator Gravel, we have a tropospheric scatter system run by the Air Force. We have the Alaska Communications System. We have some microwave lengths, some cable tied together through the major nerve centers for defense purposes. But we in Alaska do not have an intra-Alaska point-to-point communications system.

It is simply inadequate. With the new earth station, that 97-foot dish that will be put in by COMSAT at Talkeetna, I think the major service that that will perform will be to relieve the circuits for interstate communications. These circuits are so overloaded now it is a shame.

But I think we have the unique opportunity in the United States to build a totally modern communications system in Alaska without all of the conflicting interests that you find in the lower 48.

We do not have the system; we don't have a long-lines terrestrial system tying the State together. We don't have, if I can be so bold, the Bell Telephone System here that would be worrying about whether or not you could bypass some of the ground circuits and go up to a satellite and go down to another city.

I therefore think we have the opportunity now to build an optimum system using all of the technology, the state of the art which is far advanced in the United States, in building a really great communications system.

I further think there has to be a proper balance between satellite communications, microwave links and other terrestrial systems. This could be the showplace of the United States, to all the world, in what can be done in communications. To that extent I think we need the substantial help of the Congress and the administration.

Mr. KARTH. Well, thank you very much, Mr. Pollock. I might say that this subcommittee, I am sure you recognize, shares your enthusiasm.

Mr. POLLOCK. Yes, sir.

Mr. KARTH. While none of us come from the great State of Alaska, we do have a responsibility of trying to implement or apply the new technologies, that have been developed at substantial cost to the American taxpayer, for the benefit of the American taxpayer wherever he may reside.

Frankly, as far as the Chairman of this subcommittee is concerned, I see no better place to begin than in the State of Alaska, where, No. 1, they are in great need of communications, and No. 2, they don't have the built-in rockblocks that you mentioned, which might stifle under normal circumstances expeditious transferring of that technology to the people of Alaska.

I want to thank you very much. I don't think this committee has received better or more lucid testimony on the need for a greater emphasis on applications satellites than we have today from you and Senator Gravel, and we are very grateful to you.

Mr. POLLOCK. Well, Mr. Chairman, we recognize the limits which you defined in which your committee has jurisdiction. I know you are careful not to get into the jurisdiction of other committees, but we

feel that this is a particularly helpful hearing for Alaska. We feel that the very great opportunity we have in coming before you will serve us well with the other committees and certainly make them alert to some of the needs that we do have.

Mr. KARTH. Thank you. Mr. Mosher.

Mr. MOSHER. Well, I certainly want to congratulate our colleague, and I am sure you join me, Mr. Chairman. All of the members appreciate the force and clarity of Congressman Pollock's statement today. I certainly understand the urgency you express.

Speaking of urgency, Senator Gravel, who preceded you, seemed to indicate that the White House was a major stumbling block in the fulfillment of your ambitions. Is that true?

Mr. POLLOCK. No, sir. I don't think that is the case. I think if we had made specific requests of the White House which had been refused, there might be some basis for that statement. I think it is a matter of bringing together the several forces, the several agencies and departments of the Government, under one head.

I think it is very well to criticize the administration at this juncture, but we didn't just start the United States in January. We have had the problem for some time, and I share with him an expectation that this administration will resolve the problem.

I hope it will.

Mr. MOSHER. You have every reason to believe the White House is giving proper consideration to this problem?

Mr. POLLOCK. Yes, sir, I do, and I think I am aware, as you certainly are, of the many, many conflicting political interests which need to be served throughout the United States. Any decision which is made so far as a domestic satellite system is concerned is going to be a tenuous thing at best as far as general acceptance.

I think there is a reason there hasn't been an overall acceptance and an approval of a domestic satellite pilot program. I was very distressed in the early days with my good friend Joe Charyk of COMSAT because COMSAT did not include Alaska in the application for the domestic pilot project. We discussed it at some length and I have to defer to his wisdom.

I think it was a correct thing not to include Alaska at that time. I didn't see it at first, and I think the reason was that the domestic pilot project for many months, for indeed many years, has been deeply imbedded in all of these conflicting interests. Maybe, in fact, an answer wouldn't come unless we could actually use our fertile virgin territory of Alaska to demonstrate a good system and then use that as the vehicle for the total domestic system.

Mr. KARTH. Mr. Symington.

Mr. SYMINGTON. No questions, thank you.

Mr. KARTH. Mr. Pettis.

Mr. PETTIS. Mr. Chairman, I have no questions, but I would like to commend my colleague, Mr. Pollock, for a very informative statement this morning. I think it is not only informative and interesting, but I think also that he and Senator Gravel have given this committee substantial material to think about. I just hope that we can take some steps forward in the very near future to implement the suggestions that have been made this morning. Thank you.

Mr. POLLOCK. Mr. Chairman, I would like to respond to that, Mr. Pettis and members of the committee. I would like to say this. We in Alaska are very impatient people, but I think with some reason or some basis. We are so far behind all the rest of the United States in developing a transportation system; in developing a communications system; things that are very fundamental to all the rest of the United States. It is difficult to realize that you can be in one village in Alaska and have another village maybe 50 miles away and have no way to communicate at all unless you go by airplane to get over there.

Here in the United States, in the lower 48, it is so easy to just pick up a telephone and call any spot in the United States, or jump in an automobile and drive anywhere and we simply can't do these things. We want to be brought up to modern times so far as these very vital aspects of civilization are concerned, and we think in doing that, instead of just being brought up to today, with yesterday's technology, we have the beautiful opportunity to take that step ahead. We have the unique opportunity to take one big leap to get the optimum communications system utilizing all the techniques of satellite availability and knowledge to build this great system which I think this Congress could be very proud of, and which could be the demonstration showcase to all the world as to what the state of the art is, and what can be accomplished.

Mr. KARTH. Thank you very much, Mr. Pollock. I have one question. I want to join my colleagues again, however, in saying that your remarks are just replete with interesting and challenging statements, and we are grateful to you.

Mr. POLLOCK. Thank you.

Mr. KARTH. Because of the lack of time, I am going to refrain from asking a number of questions I had in mind. But I did notice that on the bottom of page 6, and let me just read to you that part of your statement, then I want to ask you specifically who you referred to.

Beginning on the bottom of page 6, you say:

> The net result of policy thus far has been to remove from the private sector of the economy the initiative and incentive for undertaking development. This has stemmed in large part from delegating to inappropriate agencies the authority for guiding development

and so on and so forth.

What inappropriate agencies do you specifically refer to?

Mr. POLLOCK. Mr. Chairman, we see from time to time different agencies being delegated responsibility to come up with studies. I think at the present time, and it is not my intent to step on any toes, the Department of Commerce is engaging in a study and trying to bring other departments and agencies into this study to try to find out what the communications needs are for Alaska.

We have an agency in the executive branch of the White House doing a study. The Department of State and the Office of Telecommunications Management is involved. We are ending up with studies, and what we want to do is to see some positive results going into the implementation of a policy and a program to bring together the kind of communications system we visualize.

I think the point that needs to be emphasized is that what we have really done is spread the issue out so far and made it so thin that everybody is going off in different directions instead of working together. I think one of the things—I said this before—but one of the

things that is so badly needed is to converge all of these energies into one channel. I think this will occur at the time we establish what I think is sorely lacking and that is a national communications policy.

We just simply don't have one.

Mr. KARTH. Thank you very much. I think that that answer more clearly establishes for the record what the specific problems are. Again I say we are grateful to you. Thank you very much.

Mr. POLLOCK. It is a pleasure to be before you, Mr. Chairman, and I thank you so much for the opportunity.

Mr. KARTH. The next witness is Dr. Charyk, who is president of the Communications Satellite Corp. And, Doctor, I hesitate, really, to ask to put some of your statement in the record, and then proceed with the rest of it, but as you know, the House goes into session at 12 noon, and the committee really has no authority to sit unless we get special permission to do so.

So I wonder, with your permission, if we could put the first 18 pages of your statement in the record—which incidentally, through very rapid scanning on my part, is most interesting, but nonetheless, I think we really get to the heart of the subject beginning with page 19.

Therefore, if there are no objections on the part of the witness or on the part of the committee, I would ask that the first 18 pages be made a part of the record, and that the witness proceed beginning on page 19.

Do you have any objection, Doctor?

Dr. CHARYK. I have no objection at all, Mr. Chairman. And as a matter of fact, I will be happy to paraphrase some parts of the statement beyond that in the interests of saving time.

Mr. KARTH. Well, I hestitate to rush you, and we can always come back another day. I wouldn't want to ask you to be excessively brief, but the first 18 pages are probably more historical in nature, and as interesting as the material is, I think we can probably bypass that without the committee missing too much of the import or the impact of your testimony.

So why don't you begin on 19, and if need be, call you back later on, Doctor, which we would be very happy to do, your time permitting.

Dr. CHARYK. Thank you, Mr. Chairman.

(The first 18 pages of the prepared statement follow:)

PREPARED STATEMENT OF DR. JOSEPH V. CHARYK, PRESIDENT OF THE COMMUNICATIONS SATELLITE CORP.

I am Joseph V. Charyk, President of the Communications Satellite Corporation. I am delighted to appear before this subcommittee, and I would like to say how appreciative we are of the interest of this subcommittee in the increasingly important problem of satellite technology as its applies to the field of communications.

It is my understanding that one of your objectives is to ascertain the status and momentum of developments in the technology associated with communications satellites and the relationship to possible operational systems that give promise of serving a wide range of public needs for communications services. I will attempt to address this subject as well as the present institutional framework, both governmental and industrial, which deals with problems relating to the utilization of this technology. I will also attempt to describe technical innovations and advancements in various aspects of the technology and to seek to explore whether or not they have been effectively utilized in the interest of the American public whose tax dollar has supported research and development in this field by the National Aeronautics and Space Administration.

Before dealing with these questions, however, let me briefly sketch the development of COMSAT which, as you well know, was created by an act of Congress in 1962 with the passage of the Communications Satellite Act that year. This law established not only the Corporation which I represent but provides it with a mandate to exploit the products of space technology research towards the establishment of global commercial communication satellite services. COMSAT was subsequently organized as the chosen instrument by which private investments could be applied for the commercial application of space technology with the public interest protected by stringent requirements for regulation and supervision by various governmental organizations.

As one of its first tasks, COMSAT was instrumental in the organization and operation of INTELSAT, the International Telecommunications Satellite Consortium, a joint venture among entities which today represents seventy countries. As a result, there now exists a highly successful and smoothly functioning communications satellite system providing international communications services on a global basis. This system provides international communications via 33 earth stations in 22 countries. At the end of 1970 we expect this system to consist of 48 earth stations in 35 countries. The international agreements which established INTELSAT were tentative and called for the negotiation of definitive arrangements at a later date. These definitive arrangements are now in the process of negotiation.

The tremendous advancements of the past ten years in satellite and launch vehicle technology were the basis for the successful global satellite communications system which I have just described. To be specific, global commercial communications via satellite began in the summer of 1965, with the successful launching of Early Bird. Early Bird was a commercial derivative of the NASA-sponsored and Hughes-built Syncom program. Early Bird provided 240 circuits, or one television channel across the North Atlantic, with a design life of 1½ years. This amazing satellite not only demonstrated the feasibility and acceptability of synchronous satellite communications, but was brought out of retirement this past summer to assist in service restoration when a much larger and newer satellite developed temporary technical difficulties. Early Bird has now been returned to retirement after serving faithfully for over 4½ years.

The development and emplacement of the second generation satellite (INTELSAT II) is now completed. This satellite provided full earth coverage so that South American countries could participate and was used to begin service in the Pacific Ocean area.

We are now in our third generation of satellites, INTELSAT III, which provides the backbone of the global system. This satellite has a capacity of 1200 voice circuits and five years life expectancy. We have one such satellite in operation over each major ocean area, thus providing global coverage. Additional satellites of this family are required, however, to adequately handle the growing traffic needs, particularly in the Atlantic. The next launch of an INTELSAT III satellite is scheduled shortly after the beginning of the new year.

Looking to the future, a fourth generation of satellites, INTELSAT IV is now under development. Each of these satellites will have a capacity in the neighborhood of 6,000 voice circuits and a life expectancy of seven years. To illustrate the benefits resulting from the increasing efficiency of satellite growth, Early Bird had a satellite investment cost per circuit year of about $16,000; INTELSAT II's cost was about $8,000; INTELSAT III's cost is now about $1,000. In 1971 when INTELSAT IV becomes available, the investment cost per circuit year will drop to about $600.

But the pace of development on the ground has been no less spectacular than progress in space. Significant advances have been made in economies, design and operation of earth stations, which constitute the essential ground portion of a closely coordinated overall system. Communications Satellite Corporation manages and operates six U.S. stations which are jointly owned with other international carriers.

The Andover, Maine, station might be considered the "Early Bird" among U.S. earth stations for satellite communications.

It was designed and constructed by American Telephone and Telegraph Company in 1961-62 as part of the TELSTAR experimental program and represented at the time the latest advance in communications technology. It greatly expanded the most modern proven technology of conventional terrestrial microwave relay systems, and added a number of advanced developments such as the super-sensitive maser for amplification of received signals, the high-power traveling-wave-tube transmitter, and FM demodulators that employed feedback principles. It

was equipped with a fully steerable horn-shaped antenna protected inside a pressurized radome made of dacron and synthetic rubber 1/16th of an inch thick. Built as an experimental facility, it had an initial capacity of establishing a small group of phone circuits to a single foreign earth station, or one TV channel.

In November of 1966, COMSAT began service through two new earth stations located at Brewster, Washington, and Paumalu, Hawaii, which represented a "second generation" design. They were equipped with 85-foot diameter parabolic "dish" antennas (no radomes) and employed more advanced electronics, including many compact solid state designs. Each station, built at an initial cost of approximately $6.5 million, was designed for compatibility with INTELSAT II series satellites, which had more limited circuit capacity because of less bandwidth and power than the present INTELSAT III satellites. The stations initially established telephone circuits to two distant earth stations, and also could handle a TV channel.

A "third generation" design came into operation during 1968 and early 1969 with the completion of new facilities at Etam, West Virginia; Cayey, Puerto Rico; Jamesburg, California, and a new antenna at the Paumalu, Hawaii, site. Experience gained through operation of earlier earth stations produced a design that employed a larger antenna 97 feet in diameter; fully redundant, mostly solid-state electronic equipment that automatically switched to backup facilities, in the event of a malfunction, to assure continuity of service. Equipment included cryogenically cooled parametric amplifiers-receivers capable of handling the full 500 megahertz bandwith of the INTELSAT IIIs, in place of bandwidth-limited masers. Built at a cost of about $7 million each, the new stations yielded near perfect reliability and a capability of establishing communications links with many overseas stations at the same time.

The Etam station, for example, by the fall of 1969 was handling 575 full-time circuits between 13 different overseas stations, plus an average of 30 to 35 hours per week of TV programming. Etam and its sister stations have an almost unlimited expansion potential, a significant factor in meeting traffic demands of future series commercial satellites with capacities of thousands of circuits each.

A "fourth generation" earth station, now under construction near Talkeetna, Alaska, about 90 miles north of Anchorage, is expected to be completed by mid-summer of 1970 at a cost of approximately $4.5 million. It will employ a 97-foot diameter antenna with proven deicing equipment mounted on the reflector, and the latest electronic equipment design, including use of integrated or "printed" circuitry in some ground control facilities. A new station on Guam, which employs a similar antenna, also can be included in this fourth generation design with Talkeetna.

The technical evolution in earth station design has been characterized through each successive generation by the search for ever lower unit costs, greater capabilities, higher reliability and improved efficiency of operation. Design improvements have made possible a reduction of about 50 percent in manning requirements in the evolution from Brewster to Talkeetna.

Progress in earth station design and operation has come about by what could be called aggressive evolution. Two factors have been influential throughout at COMSAT. First, the choice was made to exploit at every step the most advanced technology and equipment available to gain the best performance in a commercially viable system. Second, the objective had to be met of providing high-quality service to customers with the highest attainable system reliability. The result has been to shape into operational reality some of the most advanced technology in the space industry; balancing this with realistic design margins and adequate manpower to assure unceasing operation of all stations around the clock.

These tremendous advances in satellite technology and economics were made possible through complementary research and development by the government, industry, INTELSAT and COMSAT. At the same time that satellites have contributed significantly to increasing the capability and performance of international global communications system, they have also been called upon regularly to carry the burden of temporarily disrupted cables. We would be less than honest, however, if we claimed 100 percent service reliability. We are, however, extremely proud of our reliability records. The space segment system reliability for the previous 12 months now stands at 97.6 percent. The U.S. earth stations have provided 99.8 percent service reliability. Such figures for a system still in development and with yet only limited built-in redundancy represent a glowing testimonial in my opinion to the future of communications by satellite.

International television which was not possible before satellites is now a commonplace event. A dramatic example of the service available throughout this global system occurred during the moon walk in July. At that time television signals transmitted from the moon were received at the NASA tracking station in Australia. They were transmitted to the control center in Houston via an INTELSAT III satellite over the Pacific. From Houston the signal was transmitted to New York City for commercial distribution throughout the world.

From New York City the program was distributed in a variety of different ways throughout the world including, as one example, transmission to the west coast by terrestrial facilities from there to the previously mentioned Pacific satellite which transmitted the signal to Australia, Philippines, Thailand and Japan. The program received in Japan was transmitted by terrestrial facilities to a second Japanese earth station and beamed from there to a second INTELSTAT III satellite stationed over the Indian Ocean. This satellite transmitted the program to an earth station in Great Britain. From there the signal was distributed throughout the British Isles and northern Europe.

A unique feature of this telecast involved the first live television to Alaska. The distribution of the moon walk program to Alaska was handled through a military ground station at Fort Dix, New Jersey, and relayed to the forty-ninth State by way of TACSAT, a military satellite over the Pacific.

A third unique feature of the global transmission of this historic event involved the use of a NASA satellite over the Pacific. The program was transmitted from an earth station at Brewster Flat in the State of Washington to NASA's ATS satellite which carried the program to Venezuela.

Some elements or aspects of this interesting interconnection arrangement were directly due to the fact that, at this rather critical period, service through our Atlantic INTELSAT III satellite was interrupted due to a temporary lock-up of the mechanically despun antenna system and a failure of the THOR-DELTA booster to place in orbit a replacement satellite. Nevertheless, the ability to interconnect Europe and North America via Pacific and Indian Ocean satellites on a semi-routine basis was a beautiful demonstration of the flexibility and diversity of a global communication satellite system, even at a stage of development where there was not the redundancy through multiple satellites that a fully developed system will have.

## STATEMENT OF DR. JOSEPH V. CHARYK, PRESIDENT, COMMUNICATIONS SATELLITE CORP.

Dr. CHARYK. In order to begin the story of the COMSAT efforts relative to a domestic system, we have to go back almost to the time that we placed the Early Bird satellite in orbit over the Atlantic in April of 1965. From a single Early Bird in April of 1965, we have come to a full-fledged satellite system, serving the globe.

But at that time, we began the studies of the possible application to domestic needs. And in early 1966, COMSAT submitted an initial proposal for a domestic satellite communications system. We actually had a meeting here in Washington to which we invited all of the interested parties.

In the years which have ensued, the views of all interested parties on this matter have been fully expressed, documented and debated, but no concrete progress has been made toward achieving a domestic satellite system.

Mr. KARTH. What month in 1966, Doctor?

Dr. CHARYK. April.

Mr. KARTH. Thank you.

Dr. CHARYK. In this same period of time, two generations of satellites and earth stations have been placed in international service. We believe that there is more than adequate technical support for our conclusion that satellite technology can serve the needs of the American public in its quest for improved and lower cost domestic communications.

We have offered to risk our own money. We are waiting only for necessary approval to get on with the job.

In large part the ability to move ahead forcefully and decisively in any communications program is constrained by the complex maze that characterizes the organization and administration of communications in the United States both within and without the Government.

Mr. KARTH. Doctor, may I interrupt. On the bottom of page 19, you say "We are waiting only for necessary approval to get on with the job." Is there any specific agency of the Government that you have in mind?

Dr. CHARYK. What we anticipate will happen is that as a result of the studies underway by the Whitehead group, there will emerge some sort of a statement of national policy, relative to domestic communications satellites, and that this would become then the vehicle for the FCC to formally authorize the initiation of a program.

Mr. KARTH. Thank you.

Mr. MOSHER. Pardon me; this statement of national policy would have to come from the President?

Dr. CHARYK. Yes, or it may simply be a release of the study of this group, which then becomes a basis for action by the FCC. In other words, I am not sure how formal the guidance to the FCC might be.

Mr. MOSHER. At this point, when do you think that statement will come?

Dr. CHARYK. We have been expecting it for a month or two.

Mr. MOSHER. Thank you.

Mr. KARTH. And that recommendation would in large part determine whether additional legislation is necessary on the part of the Congress?

Dr. CHARYK. Yes. It is possible, of course, that the recommendation could run all the way from new legislation to simply leaving the matter completely up to the FCC. And we are not quite sure where in that very broad spectrum the report might actually emerge.

Mr. KARTH. But there is a possibility that executive action would be sufficient to clarify the situation and make it possible to proceed with the project?

Dr. CHARYK. Very definitely.

Mr. KARTH. Thank you.

Dr. CHARYK. But the formal actions then would have to be taken by the FCC. Meanwhile, I think the FCC has been reluctant to move out until the study that is underway has been completed.

Mr. KARTH. Yes.

Mr. MOSHER. But you do anticipate a positive attitude, a go sign of one kind or another?

Dr. CHARYK. I would hope to see such a sign. But I would not want to prejudge the report.

Mr. KARTH. Please proceed, Doctor.

Dr. CHARYK. Studies on improving the situation date back to the efforts of James Forrestal at the end of World War II. A study group under Secretary Rostow appointed by President Johnson covered many elements of the maze and a corollary effort by the Bureau of the Budget looked at the governmental organization problem in the communications field.

It seems clear that no truly effective policymaking capability for communications exists and that this has led to a solution of problems on an ad hoc basis and without a basic national policy as a background for the determination of the best possible answers.

The new administration has been studying the latter problem as well as the important question of the application of communication satellite technology to domestic needs and the national policy implications thereof.

As an entity which is vitally affected by the present framework to which I have referred, COMSAT is hopeful that an early resolution of these questions will be reached. The technology in which the United States is without doubt the world's leader has been adequately tested and successfully utilized in the global communications system. We believe it has many important benefits to offer on the domestic scene.

The Soviet Union has been operating a domestic satellite system for several years. Many other nations are actively pursuing the establishment of either domestic or regional systems.

Canada has established a new corporation called Telesat of Canada whose mission is to establish a Canadian domestic communication satellite system. It is hoped to have the first phase of the system operational in 1972.

As I have indicated, COMSAT has been advocating a domestic satellite system for the United States for almost 4 years. We believe that the technology is here and the need is here, and we have available the private financial and other resources to carry out the mission.

It is our understanding that it was the desire of Congress when it established COMSAT in 1962 that this new unique entity should be the vehicle for the promotion of communications satellite technology and its application to commercial needs of all types. This obligation we have sought to carry out to the best of our ability.

The congressional delegation of Alaska has expressed its keen interest in and the urgent need for satellite communications for the State. An earth station between Anchorage and Fairbanks is now under construction. And as a matter of fact, we would hope to interconnect on next July 4, for the next birthday of this country, by live television, for the first time, all 50 States.

This facility will be completed by July 1 of next year and will create tremendously increased communications capabilities between Alaska and the rest of the world. There also, however, exists an urgent need for expended communications within the State of Alaska. COMSAT is working closely with representatives of the State of Alaska, RCA, the purchaser of the Alaskan Communications System, and others with a view to providing satellite services in Alaska as soon as possible.

The best long-term viable solution to Alaska's communications needs, however, we believe to be dependent upon the existence of a U.S. domestic satellite communications system and the use of a spot beam in such a satellite for Alaska.

I might just clarify that a little bit by saying that this particular study group has been set up under the auspices of the Governor. It includes representatives of COMSAT, of RCA, of the State, and of the military. And the objective of this group is to come up with a master plan for meeting Alaska's communications needs, as a function of time.

A report of this group is scheduled for the end of January, and we have had several meetings with Alaska in the course of developing such a master plan. The State of Alaska recently requested NASA to authorize the use of ATS–1 in a demonstration program. At the request of the State we assisted in the preparation of those aspects of the proposal dealing with the technical and operational elements of the satellite system.

And as has been indicated, we have offered to make available to an appropriate experiment a 42-foot station that was initially used in the Philippines and two newer 30-foot stations that are at the present under procurement.

So our interest in Alaska has also been of some duration and our attitude actually on this demonstration program is that it should lead meaningfully into a total communications system for Alaska. And we think that is tied to an ultimate decision for a U.S. domestic system and the handing to Alaska of a spot beam in such a satellite.

Mr. KARTH. Do you want to amplify that, Doctor? That is quite a statement.

Dr. CHARYK. The demonstration program that has been discussed this morning here, as has been indicated, involves only four earth stations. It has been suggested that these might be located at Fairbanks, at Nome, at Fort Yukon, and at Kodiak.

Mr. KARTH. But you said something about a total national domestic system.

Dr. CHARYK. Yes.

Mr. KARTH. And that Alaska would be just one part of that total system.

Dr. CHARYK. Yes. The type of a satellite that we think can best meet the initial domestic needs is a satellite that in some respects is a derivative of the INTELSAT IV satellite which is now in development.

This satellite would be modified so that there would be a beam of the satellite which would be illuminating the lower 48, and one beam illuminating the State of Alaska. This satellite would have a capability for roughly 24 television channels simultaneously.

And it would appear that the initial Alaskan needs can be met very nicely by the use of several of the transponders in such a satellite. This would seem to be the most economical, the most efficient way to do a meaningful job for Alaska in the near term.

Mr. KARTH. Well, I think the benefits that might be derived by the State of Alaska are obvious, but what about the advantages that a system such as you are talking about; that is, a domestic communications system for the entire United States—what advantages would that give to the lower 48?

Dr. CHARYK. Well, we think that it could meet in an effective way a large number of requirements. We have had extensive discussions over recent months with the three television networks who look with considerable interest at the possibility of using a satellite system for the distribution of commercial television program throughout the United States.

We have offered to make a couple of television channels available in such a satellite nationwide, at no cost, to the Corporation for Public Broadcasting, so that the benefits of educational television can be brought simultaneously to people throughout the United States.

We have had extensive discussions with various computer organizations, who see the possibility of tying together computers throughout the country to provide a variety of new kinds of service as well as regular services, at lower cost.

We have talked with newspaper organizations who see a possibility for distributing material throughout the United States effectively and efficiently. And just to give you a little bit of a feel for this thing, one transponder in such a satellite is capable of transmitting simultaneously across the entire Nation something on the order of 50 million bits of information per second.

Now, there are about 40 bits, roughly, in a word, so if you think of this capability in terms of a document such as "Gone With the Wind," you would be able, if you would want to do this, of transmitting three copies of "Gone With the Wind" simultaneously throughout the United States, through one transponder, in 1 second.

I only use that as an illustration to show that the capability of such a system for handling vast amounts of information is tremendously impressive. It will provide the means for bringing information to people throughout the United States, wherever they might be, of being able to have access to information wherever it might exist, whether it be in libraries, whether it be in newspaper plants, or other centers of information and news.

So that we think there is a real potential for new kinds of service, primarily for distribution type services, that a satellite can bring to the domestic picture.

Mr. KARTH. Is that technology presently in existence, Doctor, or are there further technological advancements required before we could achieve that?

Dr. CHARYK. The type of satellite that I am describing would really be a further modification of a satellite now under development for the INTELSAT organization.

Mr. KARTH. But is the technology here, doctor, or are there technological advancements that we would be required to accomplish the objective?

Dr. CHARYK. The technology, we think, is here. In other words, there are changes that have to be made to the present design, but we would approach such changes with high confidence.

The first INTELSAT–IV is to be delivered next September, and we would think that within a couple of years a satellite of the type that I have described for domestic application could be available.

Mr. KARTH. You feel that this would have the effect of lowering communications costs within the lower 48 States, as well as in the State of Alaska?

Dr. CHARYK. We think that it would provide definite economic advantages to such services as television distribution. We think it is the only way in which meaningful communications can be brought to Alaska.

Mr. KARTH. Thank you. You may proceed.

Dr. CHARYK. Communications is only one such field, but it is basic to many others. Global weather observations via NASA satellites have long been a valuable resource for weather forecasters. We have worked vigorously to seek to initiate an initial commercial program for communications via satellite between aircraft and ground facilities.

In particular, improved communications over the international air routes are urgently needed, and we have felt that an initial capability which, of course, would not meet all the communications and navigation needs desired for an ultimate system is highly desirable.

And I am sure that many people do not realize that frequently, when you are flying over the North Atlantic, you are out of contact with land. We think in a day of rapid communications, high density traffic over the Atlantic, that is a highly undesirable situation. Satellites can provide the answer to that problem, and can provide an answer in the short term, and can provide a meaningful answer.

As we have seen, worldwide television, even from the moon, is now possible. Recent studies by the National Academy of Sciences have indicated the potential for many new services, including those related to earth resources which have possible commercial connotation.

Turning back to the technology as it relates to communications, public benefits from this technology are not measured in dollars alone. Reliable, high quality, global communications represents a public benefit far above the simple dollar value. The advantages of global television are impossible to evaluate financially.

Who can define the value or impact of global television coverage from Apollo 11? Thus far, over 1,455 hours of television have been carried over INTELSAT systems. Average television use per month has increased from 5 hours in 1965 to 32 hours in 1968; and thus far in 1969, the average is 64 hours a month. With many new earth stations in service, television reception at earth stations has increased much more dramatically.

During this time, COMSAT has reduced its television rates twice. Charges for the satellite portion of a 1-hour color telecast between New York and Europe are now only 19 percent of what they were 3 years ago—a reduction of 81 percent.

Mr. KARTH. Is that the kind of a reduction you're talking about for domestic communications, if we had a domestic satellite system?

Dr. CHARYK. No; the reductions would not be this dramatic domestically. But nevertheless, we feel that a much broader variety of service can be provided at a lower cost than is involved today.

Before Early Bird was launched about 4 years ago, the U.S. carrier portion of leased voice/data circuit between New York and France cost about $10,000 per month. Now, largely as a result of satellites, this circuit sells for about $6,000 per month. The COMSAT portion of this tariff between New York and France has been reduced from $4,200 for 16 hours a day service to $3,800 for 24-hour service.

But neither the United States nor COMSAT can afford to rest on their laurels. Time has a habit of overtaking the man who stands still. We can only maintain our leadership through action. It is difficult, if not impossible, to say exactly how R. & D. should be divided between NASA and COMSAT.

The general principle perhaps is clear. NASA's efforts support the specific interests of the U.S. Government and those long range noncommercial research activities which are essential to the growth and stimulation of this dynamic technology.

COMSAT must continue diligently to fill the gap between the NASA development program and the commercial exploitation of space technology. COMSAT has a new $16 million research facility near Clarks-

burg, Md., where approximately 150 scientists and engineers are at work on advanced satellites, new communications techniques, and improved transmissions systems. A significant percentage of the research being conducted in these laboratories is funded by INTELSAT.

Typical of the R. &. D. efforts sponsored by COMSAT and INTELSAT is the work in the area of demand assignment. The introduction of demand assignment will make it economically possible for the country with small communication needs to communicate "on demand" with all other participating countries.

At the same time that demand assignment is helping the smaller communicator realize the full potential of satellites, it provides also in effect a significant increase in satellite capacity.

COMSAT has thus far spent almost $20 million for research and development oriented toward the specific field of commercial communications satellite systems. The efforts of the U.S. Government through NASA made space technology available, and we have shaped it and combined it with our own research and development efforts to make commercial communication satellite services available on a global basis. This seems proper.

Government's need for new technology has historically led the way. COMSAT intends to continue a close relationship with NASA. We intend to complement the NASA-sponsored research and development with those efforts which are required to develop, improve, and orient specific items required for our commercial application.

Our current plan provides for a total expenditure of $45 million for research and development prior to 1972. Our foreign partners in INTELSAT will have spent an additional $25 million prior to 1972 for research and development. This research and development program is indicative of our belief that our company is dedicated toward bringing the newest in technology to the forefront.

In closing, I would like to emphasize that COMSAT has deep faith in this technology and its ability—via communications and other space applications—to create better understanding among peoples throughout the world, and to bring ever-increasing public benefits to our own Nation.

Mr. KARTH. Thank you very much, Dr. Charyk, for a very important statement, one which I think rounds out in good fashion the record that is being made during the course of these hearings.

We are deeply indebted to you, sir, for taking of your time to come up and benefit the committee with the knowledge that you have in this area.

Mr. Pettis.

Mr. PETTIS. No questions; just the observation that I wish we had more time to pursue this with Dr. Charyk, and maybe we will have more time another time. I want to commend him for his presentation this morning. It was very excellently done.

Dr. CHARYK. Thank you very much.

Mr. KARTH. Mr. Symington.

Mr. SYMINGTON. I certainly very much commend Dr. Charyk for his statement, and have but one sort of fundamental question to help clarify my understanding, and it is really based on the things that Senator Gravel said.

He says on page 10 of his statement that the one thing that the enabling legislation for COMSAT gave only passing reference to is domestic applications, thereby, I think, placing—if there is a prob-

lem of attention in that area—placing some of the blame for it on the legislation itself.

But then he goes on to say that there are two reasons for COMSAT's lack of enthusiasm, as if the absence of legislation wasn't enough, and makes two points—a conflict of interest in its board of directors, and simply repeating the first point, which is that it is pursuing an international goal.

You have stated that you have advocated a domestic system in the United States for almost 4 years. So there does seem to be a difference of understanding there, which I would appreciate your commenting on and clarifying for me.

Dr. CHARYK. Well, I think I would prefer not to argue with Senator Gravel, but I think to imply that we have had a lack of enthusiasm for moving ahead on the domestic front is really not supported by the facts.

Mr. SYMINGTON. And just a footnote there, sir. You have not felt inhibited in any respect by the enabling legislation from addressing yourself to domestic needs?

Dr. CHARYK. I think we have felt this inhibition, that to move ahead on the domestic front has required an authorization from the FCC. The FCC did conduct an inquiry as to who should be authorized to pursue a domestic communications satellite development, so therefore the FCC officially put everyone on notice that it did not assume automatically that COMSAT should be given the green light for domestic satellite development, but that all other possibilities should also be considered.

So that issue remains, and without an authorization from the FCC, of course, it is not possible for anyone to proceed.

Mr. SYMINGTON. There is no problem with the legislation; simply the FCC authorization, as you perceive it?

Dr. CHARYK. We think that all that is required is an appropriate authorization from the FCC.

Mr. SYMINGTON. And had you received such, then your real enthusiasm and advocacy for a domestic satellite system would have undoubtedly achieved it by now?

Dr. CHARYK. I think we would have been well ahead in the development and implementation of such a system.

In regard to the other portion of Senator Gravel's statement—namely, that our interest on the international scene has somehow diminished our enthusiasm on the domestic front—I think it is rather interesting that we are often accused by some of our international partners of not giving adequate attention to the international system because we are enamored of the possibilities of proceeding with the U.S. domestic system.

That is one of the reasons that has been suggested why the U.S. role in INTELSAT should be diminished, namely that COMSAT is so dedicated to an interest in domestic applications that it cannot give its full attention to the international scene.

Mr. SYMINGTON. I noticed, I thought, some shaking of heads when the figures at the bottom of page 11 of Senator Gravel's statement were mentioned, to wit, the plan to restructure voting arrangements in INTELSAT to reduce the United States from 50 to 5 percent, and increase the other European voting participation to 35.

Is that a correct statement?

Dr. CHARYK. I have no idea where those numbers came from. I have never heard of such a proposal. As a matter of fact, the discussions, as they are proceeding, are pretty much on the basis that the investment of each country should be related to its use of the system, which means that the actual U.S. participation would vary with time. It would perhaps be an annual adjustment, based on the actual use of the system.

Our use of the system at the present time is slightly under 50 percent. So if the proposals which are now before the House were to be adopted, we would start out with an initial voice of that order.

Now, it would drop with time, of course, because as new stations go on the air in other countries, and begin to use the system more extensively, our percentage would go down. But I have never heard of a proposal to actually fix the investment of any country at a particular number, and certainly not the United States at 5 percent.

Mr. SYMINGTON. Thank you very much.

Dr. CHARYK. I might just say, while we are looking at the same page, that I am also not clear as to the origin of the $4 million figure. We have paid to NASA something of the order of $53 million for launch costs, ranging all the way from all of the satellites which have been launched successfully and unsuccessfully to advance payments against launches yet to come, including a launch that won't take place until 1971; in fact we have already paid $7.4 million against that launch.

So that insofar as any billings to COMSAT are concerned, we have fully paid all of the bills that have been rendered to us by NASA.

We are aware, of course, that there have been discussions between NASA and the Air Force as to the appropriateness of certain launch cost items, and in NASA's own interests, I think it has had good reason to question why the Air Force should want to bill it for certain indirect costs.

But it is also my understanding that as a result of thorough discussions of this entire matter, that there was complete agreement reached between the Air Force and NASA as to what the appropriate billing should be, and these bills have since been submitted to us over the years by NASA, and we have paid them all.

Mr. KARTH. This $4 million, Doctor, as I understood it, really applies to future incremental payments for launches that are yet to be made. Was that your understanding?

Dr. CHARYK. No. My understanding from Senator Gravel's statement was that this applied to launches that have already taken place. However, I think it is safe to state that all of the bills that have formally been rendered to NASA by the Air Force, have in turn been submitted to us, and we have paid them all.

Mr. KARTH. We will ask NASA for a clarification of that particular point.

(Information requested is as follows:)

**The statement to the effect that the Communications Satellite Corporation (COMSAT) owes the U.S. Government $4 million in launch services costs, which NASA has not billed to COMSAT apparently refers to a problem that arose in 1966 between the Department of Defense and NASA relating to the basis on which charges would be determined for range support services provided by the U.S. Air Force at the Eastern Test Range (ETR) in connection with the launching of Intelsat satellites by NASA.**

Under Sections 201(b)(3) and (b)(5) of the Communications Satellite Act of 1962, NASA provides launching services to COMSAT, on a reimbursable basis. The costs for which the Government is reimbursed include, in addition to the costs to NASA of furnishing the launch vehicle and launching and associated services, the cost of ETR range support services provided by the Air Force in connection with each launch.

Under the terms of the launch services agreements that have been negotiated for each series of INTELSAT launches between NASA, acting on behalf of the Government, and COMSAT, which acts as the agent of the INTELSAT Consortium, COMSAT reimburses the Government for the cost of each launching initially on the basis of estimated costs, which are furnished to COMSAT during negotiation of the applicable launch services agreement. Included in such an estimate is the estimated cost of Air Force range support services.

Subsequent to the negotiation of the launch services agreement for the INTELSAT II series of launches in 1966 (although prior to its signature), the Department of Defense (DoD) proposed to NASA that the charges to COMSAT for range support services should be determined on a basis that would include all direct costs incurred by the Air Force and its contractors in support of the INTELSAT launches, and also a pro-rata charge for Air Force and contractor indirect/support costs involved in the operation of ETR. This proposal by DoD would have had the effect of increasing the costs payable by COMSAT for each launch substantially over those contemplated at the time of the negotiation of the launch services agreement, in connection with which a launching cost estimate had been furnished to COMSAT. In reliance on this estimate, COMSAT and the INTELSAT Consortium had already made certain contractual financial commitments with potential users of the INTELSAT II system. NASA therefore suggested to DoD that the proposed increase in range support charges should not apply to the pending INTELSAT II series of launches, because of the retroactive effect it would have on COMSAT and the Consortium.

The questions raised by the DoD proposal to increase the charges for range support services, and the launches to which such charges should be applicable, were discussed among NASA, DoD and COMSAT over an extended period of time. The outcome of these discussions was a decision by DoD and NASA that charges to COMSAT for range support services for the first three INTELSAT II launches should include all direct costs incurred by the Air Force and its contractors for these launches. Beginning with the launching of the fourth INTELSAT II satellite, since it had not been planned as part of the original INTELSAT II system, the charges would include both direct costs and a pro-rata portion of indirect/support costs. In due course, bills computed on this basis were submitted by the Air Force, and were fully paid.

The $4 million figure is believed to be derived from one of the illustrative estimates used in the course of the NASA and DoD discussions of this problem. It represented one of several rough estimates (which later proved to be substantially overstated) of the amount that might be charged for range support services for the first three INTELSAT II launches, and for the 1965 Early-Bird experimental launch, if the proposed DOD basis for determining range support charges were to be applied retroactively to those launches. In view of the DOD/NASA decision referred to above, the Air Force never billed NASA on this basis for the INTELSAT launches involved, and hence NASA never billed COMSAT for this amount. Under the DOD/NASA decision, the Air Force was fully reimbursed for all direct costs of range support services associated with INTELSAT II launches, and beginning with the fourth INTELSAT II launch, for a pro-rata portion of indirect/support costs also. The launch services agreements subsequently negotiated for the INTELSAT III and INTELSAT IV series of launches provide for reimbursement of range support costs on the same basis as agreed upon for the fourth INTELSAT II launch.

Dr. CHARYK. Another item of clarification. I think Senator Gravel mentioned a number of a hundred million dollars for an Alaskan system. I am not sure where that number comes from.

In the type of satellite system that I have described, namely where a spot beam of the U.S. domestic satellite would be used to serve Alaskan needs—probably the annual revenue requirement to meet all of the basic Alaskan needs would be of the order of $7 to $8 million a year.

Mr. KARTH. I think he was referring specifically to a satellite communications system for domestic use in Alaska alone, where all of the costs of the total system would be borne by that State, as opposed to a system to be used and thereby spread upon 49 States.

Dr. CHARYK. Well, the revenue requirement for the entire system that I have described, which includes the service to the lower 48, plus Alaska—we would anticipate would be somewhere between $30 and $40 million a year. This involves a single satellite with a 24-television-channel capability, and a complete spare in orbit, so that in the event of any misbehavior of the primary satellite, all of the traffic could be shifted to the spare satellite.

Mr. PETTIS. Would you please state that again?

Dr. CHARYK. There would actually be a 48-television-channel capability in orbit, but one of the satellites would be a complete spare. Such a system would have an annual revenue requirement, we estimate, somewhere between $30 and $40 million a year.

Mr. SYMINGTON. Is that the system which would be in existence today, if you had received FCC authorization?

Dr. CHARYK. No, it is the system that we would pursue if we were given the authority today. A new element that has entered during the last 2 years is, of course, the decision by Intelsat to go ahead and develop an INTELSAT IV satellite for international needs. Now, it evolves that a derivative of that satellite is a very nice way to do the domestic job.

Mr. SYMINGTON. So that there need not be, and in fact is not, in your view, a conflict of interest, as far as you are concerned, between COMSAT and the aims of INTELSAT.

Dr. CHARYK. To the contrary. I think that there is a possibility of mutual advantage, because in the event that we were authorized to proceed with a domestic system, we would go to INTELSAT and propose to pick up a portion of the research and development bill for the development of the INTELSAT IV satellite.

So there would be an advantage to INTELSAT in that the cost to it of developing INTELSAT IV would be reduced, since part of this cost would be charged against the U.S. domestic system. So INTELSAT would end up with an INTELSAT IV satellite, and the United States would end up with a domestic system, with the research and development costs shared between the two developments.

Mr. SYMINGTON. Would this affect our voting strength in INTELSAT?

Dr. CHARYK. No.

Mr. SYMINGTON. Would it have any bearing on that?

Dr. CHARYK. Our voting strength in INTELSAT would be related to our use of the international system.

Mr. SYMINGTON. Thank you.

Thank you, Mr. Chairman.

Mr. KARTH. Going back, Dr. Charyk, to page 11 of Senator Gravel's statement, at the bottom of that page, where he talks about the reduction of U.S. influence in terms of voting arrangements in INTELSAT, we did question Senator Gravel about that, and he feels comforted with the idea that the source of his information is impeccably accurate. I am not in a position to disclose the source at this point.

Dr. CHARYK. If such a decision were reached, it has never been surfaced, and is not included in any of the proposals made by any of the countries which have participated in the international negotiations over the past year.

Mr. KARTH. I understand that that is the case, that this has not surfaced, and it is not publicly known.

I have a series of questions, Doctor, but in the interests of time, I think I will either submit them to you in writing, and will hold the record open until such time as you can reply, or pose them later should we decide to reschedule your appearance.

One question, however, I would like to get in the record at this point is in regard to the Johnson task force group report of some time back, and I am sure that you are completely familiar with it.

I think there were two major recommendations: first, that a single U.S. communications entity be established for all international communications, and second, that there be open competition for all types of communications carried domestically.

Do you agree with those two recommendations? Do you agree with either one? And if so, which one? I would like to know what part you may disagree with, and the reasons.

Dr. CHARYK. As I recall the final report, it was not explicit on the authorization for a domestic satellite system, but it did indicate that there should be a focal point for the initial development of a domestic system.

In other words, we were not yet at the point where we could justify multiple domestic systems from a technical or operational or economic point of view. We needed a domestic system, but we needed only one to meet a variety of requirements.

The question then that was left somewhat open was, What would be the vehicle for the development of such a system? Who would be authorized to develop this single initial domestic system that was needed?

Our position has been that Comsat should be selected as the vehicle for this initial development. The Rostow report, I think, would have left this determination up to the Federal Communications Commission after reviewing applications from various entities for authority to develop and emplace such a system.

Mr. KARTH. Well, I had understood that the recommendation was that a single entity would handle all international communications, but you said your recollection was that the report recommends a single entity for domestic communications. I may well be wrong.

Dr. CHARYK. Well, I think the Rostow committee did not visualize that one could justify a number of domestic satellite systems but felt that there should be but one initial domestic satellite system. The question that was left open was who or what combination of parties should have the responsibility for developing and operating the total system.

Mr. KARTH. Are there further questions?

Mr. SYMINGTON. No, thank you.

Mr. KARTH. Counsel?

Mr. HAMMILL. No questions.

Mr. KARTH. Thank you very much, Dr. Charyk. With your permission, the committee may want to get in touch with you at some future date and resume questioning on these matters, since I believe time has not permitted us to explore them fully. We are grateful for that testimony. Thank you very much. You have been very helpful to us. The meeting is adjourned until 10 o'clock tomorrow morning.

(Whereupon the subcommittee was adjourned, to reconvene the following morning, Thursday, December 18, 1969, at 10 a.m.)

# ASSESSMENT OF SPACE COMMUNICATIONS TECHNOLOGY

THURSDAY, DECEMBER 18, 1969

HOUSE OF REPRESENTATIVES,
COMMITTEE ON SCIENCE AND ASTRONAUTICS,
SUBCOMMITTEE ON SPACE SCIENCE AND APPLICATIONS,
*Washington, D.C.*

The subcommittee met, pursuant to notice, at 10 a.m., in room 2325, Rayburn House Office Building, the Honorable Joseph E. Karth (chairman of the subcommittee) presiding.

Mr. KARTH. The committee will be in order. This is our third day of hearings on the applicability of satellites to domestic communications. I might announce at the outset that since the committee did not have time yesterday to hear Mr. Plummer's complete testimony, the Acting Director of the Office of Telecommunications Management will be back tomorrow morning at 10 o'clock. We may also have back before us at that time Dr. Joseph Charyk, president of the Communications Satellite Corporation; he didn't have a full opportunity to express his views on Tuesday.

The first witness this morning is Mr. Howard R. Hawkins, president of RCA Global Communications, Inc. Mr. Hawkins, is there someone you would like to have with you at the witness table?

Mr. HAWKINS. I have my associates right here. They are right behind me.

Mr. KARTH. Fine. If you find it necessary to have any one of them assist you, I wonder if you would identify him at that time for the record.

Mr. HAWKINS. Yes, I will.

Mr. KARTH. Please proceed, sir.

## STATEMENT OF HOWARD R. HAWKINS, PRESIDENT, RCA GLOBAL COMMUNICATIONS, INC., AND PRESIDENT, RCA ALASKA COMMUNICATIONS, INC.

Mr. HAWKINS. Chairman Karth and members of the subcommittee, my name is Howard R. Hawkins. I am president of RCA Global Communications, Inc., and also president of its wholly owned subsidiary RCA Alaska Communications, Inc.

I am pleased to have been invited to meet with your subcommittee to discuss the enormous potential benefits of space satellite research and development for international and domestic communications. Communications touches and concerns every group and individual in society and is one of the most technologically explosive areas of economic activity.



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Communications satellites are among the most exciting and promising of the new communications technologies.

RCA's involvement in and commitment to satellite communications is long standing, substantial, and growing.

RCA Globcom, an authorized international voice/record carrier, has participated extensively in the development of satellite communications. It will increasingly use satellites in providing global communications services. RCA Globcom is a joint owner of the six U.S. earth stations, and it is a major owner and the operator of the new Guam earth station. Today, RCA Globcom provides services via satellite communications facilities between the United States and 25 countries around the world, and it is rapidly expanding its global satellite facilities to serve Government and commercial customers.

RCA Globcom has a stock ownership in COMSAT. However, it has not sought and does not hold a directorship in the COMSAT Board.

As you know, on June 26, 1969, President Nixon announced the acceptance of RCA Globcom's proposal to purchase and operate the facilities and business of the Alaska Communications System. This acceptance followed many weeks of Federal and State evaluation of all of the competitive proposals and had the approval of the Air Force, the Department of Defense, the Department of Justice and the Governor of Alaska. RCA Alascom was organized as an Alaska entity to acquire the ACS and to operate as the long lines commercial communications carrier in Alaska. RCA Globcom and RCA Alascom are proceeding expeditiously to implement the transfer of the ACS, which is scheduled for July 1, 1970.

We believe Alaska will provide the crucible for important developments and implementation of satellite communications applications. RCA enthusiastically accepts the opportunity to play a vital role in that development in providing commercial communication service for Alaska.

Robert W. Sarnoff, president of RCA Corp., described RCA's purchase of the Alaska Communications System as "the culminating step in our long association with Alaska in the creation and operation of major communications projects for both civilian and military purposes."

Mr. Sarnoff also stated:

"As a company which has pioneered in electronic communications, we welcome this further opportunity to join our future to that of a pioneering people. All of the technological resources at our command will be available to give Alaska one of the most efficient and modern communications network ever devised."

RCA Globcom will purchase the ACS from the Air Force for $28.4 million. It has agreed to invest an additional $27.6 million over 3 years in expanding facilities and improving services.

There are, I might add, urgent and immediate requirements for improvement of service in Alaska.

RCA Globcom's commitment to the people of Alaska includes rate reductions averaging over 29 percent of interstate service, and nearly 40 perecent for intrastate service. These reductions will save users about $40 million over the first 3 years of RCA operations and bring such Alaska rates on a par with those in the "lower 48." It is estimated that the economy of Alaska, through implementation of RCA Globcom's

commitments, will participate in public benefits amount to nearly $125 million over the next few years.

Communications satellites are, of course, expected to play a major role in the development of an efficient and modern communications network in Alaska. The State of Alaska is of immense size, but its population density is less than one-sixth that of Nevada, according to the 1960 U.S. Census, and less than one one-hundredth of that of the entire United States. Because of these facts, transportation and communications are frequently significantly less economical than in the "lower 48"; because of climatic and terrain conditions they are more difficult. Existing communications facilities are limited, often rudimentary, and in some remote areas nonexistent. Thus, RCA and Alaska are confronted with a unique challenge and opportunity to construct the best and most efficient communications network for the State.

For all of these reasons, communications satellites promise to play a prominent role in Alaska communications services. In RCA Globcom's proposal to purchase the ACS, major emphasis was placed on the role of satellites in the development of interstate and intrastate telephone, data, television transmission and other services.

Since the ACS award last June, our engineers have been working to refine the parameters of satellite communications for Alaska that will narrow the options and provide us with the basis for making technical and economic decisions. These decisions are necessary to determine the course of action that will best serve communications needs for the State of Alaska.

We have undertaken a special RCA Alascom project, which we have called Project Alsat, to develop a comprehensive satellite/terrestrial master plan for Alaska. This is intended to provide for the optimum communications system for Alaska considering technology, cost effectiveness, requirements and timing for the future. The study will seek to define possible uses for satellite communications in the State which are required and justifiable from an economic and service standpoint.

In addition to normal telephone and telegraph services, satellite communications can play a crucial and indispensable role in providing educational and commercial television services to all parts of the State.

The technology of a satellite system is available for serving Alaska. Provision for some or all of the following services should be considered:

Intercity telephone, telegraph and data circuits for both military and civilian use.

Telephone, telegraph, and data connections to the smaller villages.

Television transmission for entertainment and cultural broadcasts, news, sports, special events and general education for adults and children.

Wideband data channels for rapid transportation of bulk information not possible with voice-grade facilities.

Broadcasting for entertainment, news, education and disaster information.

And, of course, aeronautical, marine and mobile-station communications.

Even though the FCC has not yet given its final approval to the purchase of the ACS, RCA Alascom has already initiated or joined

in a number of projects designed to speed and advance the development of satellite communications in Alaska.

RCA Alascom has applied for FCC authority and committed itself to assume a major role in ownership and operation of the Talkeetna earth station. RCA Globcom was first to urge that construction of the Talkeetna station be advanced so that it will be available for urgent service requirements by July 1, 1970, COMSAT has fully cooperated, and has agreed to this proposal, and construction is moving ahead on that schedule. RCA Alascom initially expects to operate 80 or more satellite circuits for expanded telephone service between Alaska and the "lower 48" in time to meet the summer peak season in 1970. It will also offer live television transmission, as well as other wideband service.

Working with Federal and State governments, RCA Alascom is cooperating in the program to implement a trial of the use of satellite earth stations utilizing NASA's ATS–1 communications satellite. This program would demonstrate the feasibility of instructional television transmission for schools in daytime and for adults at night.

As part of this demonstration program, RCA Alascom has agreed to make available without service charge the RCA 42-foot transportable earth station now located at Guam, together with a supervisory technician for the test operation of the earth station in Alaska. COMSAT also has offered a similar 42-foot station, which I understand is now in the Philippines. These two earth stations actually are comparable in design.

In addition, we have undertaken the RCA Project Alsat mentioned earlier. Project Alsat is a major undertaking which, we believe, will have a substantial role in shaping the future development of satellite communications in Alaska and possibly in other areas.

RCA Alascom also is participating in other studies and analyses of the effective and optimal use of satellites in the State of Alaska. Governor Miller of Alaska has established a task force to study this problem, and RCA Alascom, together with COMSAT, is a full participant. RCA Alascom, through its Project Alsat and other efforts jointly with Comsat, will fully contribute to this important effort.

An intergovernmental committee under the leadership of Dr. Clay T. Whitehead has also been established to study the orderly introduction of satellite communications into the communications network of the State of Alaska. RCA Globcom has made a presentation to the committee and is pleased to participate.

In our studies of satellite communications, it has become apparent that new techniques and system arrangements will be necessary in order to evolve the most cost-effective approach for Alaska. For example, the mere application of the present large earth station design with a 97-foot antenna, multiple carrier systems and complete redundancy will not lead to a cost-effective solution throughout Alaska. Instead, the matter can best be approached from an integrated system viewpoint which examines trunk requirements, growth, the existing and potential telephone plant and potential sites for earth stations. We can then determine on the basis of total circuit requirements the best tradeoff between satellite and earth station configuration and size.

We need to consider the service potential and economics of the use of smaller lower cost earth stations, spread through rural areas versus more complicated earth stations centrally located and connected by terrestrial facilities. Consideration also should be given to the use of new multiple access and demand assignment techniques to time-share circuit facilities among the lower volume users and to the use of small unattended stations with minimum redundancy to optimize the combination of operating and maintenance costs and equipment costs.

A logical phase-in program will permit the orderly introduction of satellite earth stations in Alaska, while at the same time making maximum and cost-effective use of existing and potential terrestrial facilities to fulfil' the immediate and urgent communications needs of Alaska.

Here I should like to add that we have, RCA Alascom, as a long lines communications carrier in Alaska, has a twofold problem. It has an immediate near-term problem, as well as a long-term problem. We must provide quickly for the near-term communications requirements of the people of Alaska. We have to look towards immediate solutions to meet the immediate communications needs in the near term. While at the same time we are vitally concerned with the best, most cost-effective, long-term solution for the State of Alaska.

I might point out that the use of a satellite system impacts not only the transmission facilities but also the toll switching and other equipment. Satellite systems provide point-to-point capabilities which in some cases would bypass the normal toll switching centers where not only alternate trunk paths are available, but also where the toll ticketing function normally takes place. It is therefore necessary to include in the satellite study alternate means for providing the normal backup routes and also to include alternate arrangements for providing the accounting information. Therefore, the Alaska long lines carrier is ideally situated to play a key role in planning and implementing satellite communications for the people of Alaska.

Further, I would stress that the communications needs of the State of Alaska can properly be viewed as an integrated whole of which satellites are an essential element of growing importance. The total Alaska communications network must be planned on an integrated, unfragmented basis.

I want to stress that all of these activities and many others are going forward now, even though the regulatory steps which must precede the purchase of the Alaska Communication System by RCA have not yet been completed by the FCC and the Alaska Public Service Commission. Time is extremely short. Under its purchase agreement, RCA Alascom will take over operation of ACS on July 1, 1970—less than 7 months from now. Expedition is, therefore, essential.

At present there are attempts by entities which did not bid on the Alaska Communication System and business to fragment the system, and this question is before the regulatory bodies. Prompt regulatory decisions maintaining the integrity of the ACS and removing the uncertainties would most effectively promote the early and full implementation of a modern communications system, particularly including satellite communications techniques, for the State of Alaska. I should like to add here that we understand and appreciate

the problems of the FCC, as the regulatory agency, but we do hope that this matter can be expedited.

RCA knows from its own experience that satellite communications is efficient and economically justifiable in many applications. The number of such applications will increase. As we determine the scope and feasibility of satellite communications for Alaska, it is well of course to keep in mind the timing requirements for immediate improvements in service as well as the economics of satellite communications. We hope that satellites will play a vital role in meeting the telephone, educational, and instructional television, and other communications requirements of the State. They can best play their full and proper role through integration into a comprehensive and fully planned communications network which makes appropriate, efficient, and economical use of various modes of communications.

The Alaska Communication System is one of the most exciting challenges RCA has ever undertaken. We share with the State of Alaska a deep commitment to provide the best, most efficient, and most economical communications system for all of the people of the State at the earliest possible time.

We are anxious to get on with the Alaska job. Now, I understand that the record will be open for a few days, and if there is any further information that may be helpful, I would be pleased to send it for the record.

Thank you.

Mr. KARTH. Thank you very much, Mr. Hawkins, for a presentation that I think gives this committee a better idea of where we are, and where we have yet to go.

Mr. HAWKINS. Thank you.

Mr. KARTH. Mr. Mosher.

Mr. MOSHER. Well, Mr. Chairman, I am impressed with the vigor with which RCA seems to be moving to meet this crucial need in Alaska as evidenced in Mr. Hawkins' statement.

I notice, Mr. Hawkins, on page 2 you say that Alaska will provide the crucible for more developments in the implementation. And throughout your statement in several places you emphasize the importance of an integrated system, that any use of satellites has to be integrated with other elements in the system, and at one point you expressed the hope that the system won't be fragmented.

Thinking of Alaska as a crucible, do you think of this as an experiment, as a demonstration where we can learn a lot about the use of satellites, in an integrated system, where we can learn a lot that can be transferred and made useful in the lower 48? Are you thinking of this as a crucible and a demonstration that has a much wider significance?

Mr. HAWKINS. We think of satellite communications in Alaska from three viewpoints. First, it gives us an opportunity for immediate improvement in service through the Talkeetna earth station. Here is an opportunity for us to immediately expand particularly the telephone service requirements, commencing next July 1.

This is a first immediate step that will be possible through the Talkeetna earth station, and use of the INTELSAT 3 satellite in orbit over the Pacific. That is point one.

Point two is that the demonstration program which is now underway, and which RCA is participating in, will provide opportunities for demonstrations with respect to satellite communications, and there we may well learn and certainly we expect to learn important information that may be helpful.

The third——

Mr. MOSHER. You mean helpful for use elsewhere?

Mr. HAWKINS. Yes, helpful in Alaska and also uses elsewhere.

Mr. MOSHER. Including the lower 48.

Mr. HAWKINS. Yes. And then the third point is that you will recall I made a special point in my testimony that in our studies of satellite communications, we believe, it has become apparent to us that it will be necessary to involve the most cost effective approach for Alaska, and I want to say we just couldn't build 97-foot earth stations throughout this large State, with its sparse population.

And these are the kinds of earth stations that have been built around the world today. Most all of them in commercial, virtually all of them in commercial service are of this size.

Now, my third point follows the foundation I have laid, namely, that here is an opportunity through logical developments to use smaller earth stations, perhaps 32-foot or less, and other technological developments to meet these unique communications service requirements and the experience here can be helpful and certainly we would expect it to be helpful in other areas, similarly situated.

Mr. MOSHER. Well, the cost considerations in Alaska, I assume, might be very different than the cost considerations in the lower 48.

Mr. HAWKINS. In some respects they would. But we do have, of course, in the lower 48, some rather sparsely populated areas. So while we do not have in Alaska a New York metropolitan area or Los Angeles or areas of that kind, there are some comparable situations in the lower 48, and indeed in certain other countries around the world.

Mr. MOSHER. I assume that the potential use of satellites for communications in the lower 48 would also be only in terms of an integrated system. Considering the sophistication of the present system we have in the lower 48, satellites still have possibilities, but you only consider them in terms of using them in connection with existing facilities and integrating them into the existing system, is that right?

Mr. HAWKINS. Well, I think this is correct. I would add by way of explanation that, of course, due to the excellent work that has been done in the lower 48 over several years, we have a much more advanced communications system in the lower 48 today, because of the work that the Bell System has done and other telephone and telegraph companies in the lower 48.

So that here there are ways now to provide communications, to meet communications requirements in the lower 48, that just aren't presently available in Alaska.

Mr. MOSHER. On page 1 of your statement, you refer to the realm of communications as being one of the most technologically explosive. Are you suggesting that the technology of communications at its present point is still rather primitive, that this explosion is going to take us into areas and uses and integrations that we don't even contemplate yet?

Are we still in a primitive state in communications or not?

Mr. HAWKINS. I would answer your question by saying that we have made very great progress in electronics and communications in the last many years. But there are many more opportunities ahead, as the technology evolves. So while we are well advanced, there are many more opportunities ahead of us——

Mr. MOSHER. Yes.

Mr. HAWKINS (continuing). To apply communications techniques in the period of the 1970's and in the 1980's. And here you might almost look at this problem on a worldwide basis. By present standards around the world, the United States has a very advanced communications system. In many areas of the world they are less advanced. But technology certainly will provide great opportunities for all kinds of new developments in the period ahead.

Mr. MOSHER. Well, you are talking about opportunities for the application of new technology, but do you anticipate that there is still a realm of new knowledge and still more advanced and sophisticated technology that we have hardly gotten into? Or can't you anticipate that?

Mr. HAWKINS. I think we can anticipate further developments. Certainly we all know about the lasers and waveguides and things of that kind. But some of the greatest applications that are likely to come about in the foreseeable future are the new applications in combinations of electronics and communications through the computer and satellites, and all other kinds of systems which have become technologically possible.

Mr. MOSHER. At least the possibilities and the opportunities are so great that we should be vigorously pressing ahead?

Mr. HAWKINS. Yes, we should.

Mr. MOSHER. That is the burden of your statement?

Mr. HAWKINS. Yes, that is right.

Mr. MOSHER. Mr. Chairman. Thank you.

Mr. KARTH. Mr. Symington.

Mr. SYMINGTON. Thank you, Mr. Chairman.

Mr. Hawkins, I wonder if you could amplify further the third paragraph on page 9, the suggestion that there are entities which are making attempts to fragment the system.

Mr. HAWKINS. Yes.

Mr. SYMINGTON. What are those entities?

Mr. HAWKINS. Yes, perhaps I could lay a little foundation for my answer to your question. Congress, in 1967, passed the Alaska Communications Disposal Act. This was a comprehensive piece of legislation that provided for the sale of the Alaska Communications System.

It authorized the Secretary of Defense to go through a comprehensive competitive bidding process, in which all parties interested in purchasing the Alaska Communications System were given opportunities to respond to an RFO.

Now, this request for offers was released by the Air Force, to which the Secretary of Defense had delegated the authority, in the latter part of 1968, and all concerned were invited to bid on acquisition of the system and submit proposals by March 1, 1969.

RCA was one of the companies that decided to bid on the system. There were comprehensive public interest criteria set up in the legis-

lation, basically the formula was the price for the system, the program for service improvement and the rate reductions to be offered the public.

This was a three-part formula together with a number of subsidiary points to be considered in the evaluation. Among those who bid on the system were General Telephone and Electronics, and Continental; I believe Universal Telephone also bid on the system.

When the evaluation process was completed, President Nixon announced his approval of the award to RCA at the end of June. This award was subject to the issuance of certificates of public convenience and necessity and radio licenses by the FCC.

Promptly what has happened, three entities entered the picture, none of which had bid on the Alaska Communications System.

Mr. KARTH. Would you identify those for the record, please?

Mr. HAWKINS. Yes. One of them was the Western Union International, Inc., an international record carrier. The second one was the Matanuska Telephone Association, Inc., which operated in the Matanuska Valley area of Alaska. And the third one was the city of Anchorage, which owns and operates the Anchorage Telephone Utility.

A very basic and vital part of the program called for by the Air Force RFO was the construction of the microwave link to interconnect the earth station with the city of Anchorage. The earth station at Talkeetna is about 90 miles north of the city of Anchorage and it is necessary, of course, to have a high-capacity microwave system to connect with the city of Anchorage.

The RFO from the Air Force provided for construction of that link, because it is an essential element of the long-line system in Alaska. We of course have applied for that authority, but we are now confronted with competing applications by the Matanuska Telephone Association and by the Western Union International, who made no offer to acquire the system, and have undertaken no financial commitments with respect to it.

The ACS system has four basic toll centers. The key switching centers, toll centers for the State. One is at Anchorage, one at Fairbanks, one at Ketchikan, and one at Juneau.

The ACS has traditionally operated the toll center at Anchorage, which telephone calls now are handled by manual operators, who take the telephone calls and switch them manually either to the lower 48 or elsewhere throughout the State.

As part of the program outlined by the Air Force and to which we responded in our proposals, we provided for extended-direct-distance dialing. This, of course, is well known to us in the lower 48. It is essential to improvement of service and it is also essential to encourage the development of additional telephone traffic with the reduction in rates.

For example, we have offered in our proposal to put in $1-after-midnight rate for telephone calls from Alaska to the lower 48. The city of Anchorage is now seeking to take away from the ACS system the Anchorage toll center and the DDD equipment.

Again, through regulatory proceedings before the Commission.

Mr. SYMINGTON. I would like to ask you another question, just to get the concepts more firmly in mind. Supposing in St. Louis, Mo., if we had a satellite earth station, we could communicate with Euro-

pean countries. Is this the kind of service that you could provide, or a similar organization, through the use of satellite communications?

Mr. HAWKINS. Yes. This is entirely possible technically. Now today, telephone services, by satellite transmission, and also telex service to Europe, are mainly routed through the Etam, W. Va., earth station. This is a large new earth station which is the main earth station for trans-Atlantic and Latin American Traffic.

Now, a call originating, say a Telex call or any communication originating in St. Louis is routed over land-line facilities into Etam, W. Va., for transmission. Now, it is entirely possible of course with the technology to have an earth station which would transmit directly to the satellite from St. Louis and come down in London or Paris or anywhere else.

Though this is entirely possible from a technological viewpoint in sound system planning, consideration would always need to be given as to whether that is the most efficient cost effective way to serve St. Louis, or is it better to funnel that traffic over terrestrial links into Etam and put it out on satellite channels from that point.

But if you translate your question into Alaska, we can foresee the time down the road where rather than coming from Anchorage, say, or Fairbanks, down through an earth station in Jamesburg, Calif., it may well be possible to come to an earth station not only in California but perhaps in the eastern part of the United States, and you eliminate the transcontinental terrestrial link.

This can be done from any area to which you can see the satellite.

Mr. SYMINGTON. Yes. But you have no opinion at the moment as to whether it would be cheaper to communicate from the Midwest to Europe via satellite than it is today, overland and then cable?

Mr. HAWKINS. I don't feel that I have studied the question sufficiently to give you an informed answer. It would be my anticipation that at the present levels of traffic with Europe, it is probably more efficient to continue as the service is now being handled, although I am sure Mr. Hough of A.T. & T. can give you a very informed answer on that question.

Mr. SYMINGTON. Thank you.

Mr. MOSHER. Will the gentleman yield?

Mr. SYMINGTON. Yes.

Mr. MOSHER. Going back to this communications between St. Louis and the continent of Europe, via satellite, assuming there was a ground-based station in St. Louis, what would be the time elements in the transmission of voice communications? Could a person in St. Louis talk back and forth with someone in Paris?

Mr. HAWKINS. Yes.

Mr. MOSHER. Just as you would on the telephone in St. Louis to Webster Grove?

Mr. HAWKINS. Yes. Actually, the round trip transmission time from the earth station and the satellite and back—remember the satellite is 23,000 miles up in space—the round trip is six-tenths of a second, as you know. So if you transmitted from an earth station in St. Louis directly to Paris, you would have the transmission time from St. Louis to Paris.

Now, actually a call originating in St. Louis and switched into the earth station in Etam, the transmission time would be virtually

the same, because there would be a small transmission time to Etam, but it wouldn't be significant.

Now, I would like to add another point here that is of some significance to this question. When we talk about service, say, from St. Louis to Europe, or any other foreign country, we always must keep in mind the desires, position, independence of other foreign countries, who would have to agree to the manner in which the service is to be engineered and provided.

And they might find, for cost or engineering reasons of their own, the German Deutsche Bundespost, for example, might feel that it is more to their interest to see that the traffic from the United States goes through a single earth station in the United States.

Although from a technological point of view there is no problem.

Mr. SYMINGTON. You make a distinction today, I suspect, between what might be called domestic service and international service, in telephonic communications. Would the advent of satellite communications in any way change the concept of what is international service as distinct from domestic service?

Mr. HAWKINS. I suppose I would say that technology alone doesn't change the question of whether a message is between two points within the United States, or between the United States and a foreign country, which makes it domestic or international.

But as the technology develops and we apply satellites, it does open up opportunities for handling international communications in different ways. It is possible, for example, to jump the gateway, so to speak, with satellites.

Mr. MOSHER. Satellites shrink the earth.

Mr. HAWKINS. They certainly shrink the earth, yes. Put a satellite over the Atlantic and it can illuminate a substantial area. But at the same time we have to keep in mind that we just can't put one satellite up and see everything in the world.

It takes roughly three satellites around the world, with properly positioned earth stations, to communicate everywhere. Now today, we have two earth stations on the east coast and two on the west coast.

Mr. SYMINGTON. Thank you, Mr. Hawkins. Thank you, Mr. Chairman.

Mr. KARTH. Mr. Hawkins, on page 1 you seem to wrap up a good deal of authority in one paragraph, and I would just like to explore more your understanding of what you really mean.

In the last paragraph on that page you say RCA Globcom is an authorized international voice record carrier, has participated extensively in the development of the satellite communications. You mean in cooperation with COMSAT?

Mr. HAWKINS. Yes. I mean in cooperation with COMSAT, and also I meant by that to encompass the activities in which we have been involved, even prior to the creation of COMSAT in 1963. We have been very active in this field, from the beginning of satellite communications, and when I refer to being an authorized international carrier, I am using the term there in two respects.

I am using it as it is referred to in the Communications Satellite Act, and of course all of the satellite communications service that we provide today are of course authorized by the Federal Communications Commission, and when I say authorized by policies or decisions of the

Commission, we are a carrier which is authorized to provide international voice and record service.

Mr. KARTH. But with the use of satellites?

Mr. HAWKINS. With the use of satellites——

Mr. KARTH. As COMSAT is authorized?

Mr. HAWKINS. COMSAT, of course, is a carrier's carrier. And COMSAT doesn't serve the public. COMSAT provides facilities to the carriers which they then use, integrated with their other facilities, to provide service to the public.

Mr. KARTH. And that is the distinction you make here?

Mr. HAWKINS. Yes; that is an important distinction.

Mr. KARTH. Yes.

Mr. HAWKINS. Of course, we jointly own with COMSAT the seven U.S. earth stations—although in six of them, the four mainland and the one in Hawaii and the one in Puerto Rico, COMSAT is the operational manager of these stations and has 50 percent of the ownership.

The remaining 50 percent is divided among the carriers, mainly A.T. & T., ITT, Hawaiian Tel and Western Union International and RCA.

Mr. KARTH. Do you feel that you have authority to be a carrier's carrier, on an international basis, with the use of satellites under existing authority?

Mr. HAWKINS. We are not now a carrier's carrier.

Mr. KARTH. But do you feel under existing authority, or under existing law, that you are not legally restricted from being a carrier's carrier?

Mr. HAWKINS. I would have to be rather careful in how I answer that, not to give you the wrong answer.

Mr. KARTH. Take as much care as you want, but try to be specific.

Mr. HAWKINS. All right. That is a fair bargain. Let me start out by picking up the Satellite Communications Act first. Here Congress specified in the Communications Satellite Act of 1962 that COMSAT would be the authorized U.S. entity to participate in the establishment of the global system.

Therefore COMSAT is the U.S. entity that participates in the INTELSAT arrangement. With respect to ground stations, however, Congress also specified that ground stations should be authorized to COMSAT or the carriers as will best serve the public interest, convenience and necessity, and here I would answer your question by saying we could be authorized to provide and operate a ground station which in turn could be used by other carriers.

Mr. KARTH. You could be authorized?

Mr. HAWKINS. Yes.

Mr. KARTH. But at the present time you feel that you are or are not?

Mr. HAWKINS. We are authorized jointly, in other words, all of the carriers today are jointly authorized to own the six U.S. earth stations, and all of our joint ownership is available to all of the carriers, for such service to the public as the FCC may decide or may authorize.

Mr. KARTH. I will have to read that in the record and see if I understand your answer.

Mr. MOSHER. Mr. Chairman, may I interrupt?

Mr. KARTH. Yes, Mr. Mosher.

Mr. MOSHER. Is the present arrangement so satisfactory that there is no thought on your part or other corporations' part, as seeking the same franchise, essentially the same type of franchise that COMSAT has, to be a carrier's carrier in the satellite field?

Can you see any time coming when there will be competition with COMSAT from other entities?

Mr. HAWKINS. Of course there is always that possibility, down the road. I would say that, to be more specific to your question, we do feel that we have a large measure of expertise, and have the capabilities of operating the U.S. earth stations on the mainland, and we think that we could do that at least as well if not better than COMSAT and more economically.

Mr. MOSHER. You are talking about facilities on land.

Mr. HAWKINS. Earth stations.

Mr. MOSHER. Yes, earth stations. I am talking about satellites. COMSAT is a carrier's carrier, so far as the operation of the satellites is concerned. Is that correct?

Mr. HAWKINS. That is correct.

Mr. MOSHER. Is the present arrangement sufficient and satisfactory? Or do you see any possibility that there will need to be competition up in the satellite area? Of course there could be competition from some other nation, I understand that; Russia, for instance. But is there any reason for Congress or the Federal Government to consider the authorization of a competing situation in the operation of satellites, as a carrier for the carriers up there? I am not sure of my terminology.

Mr. HAWKINS. I think I understand your questions. Let me say, first, that in 1962 Congress passed the act at the time it did because it was seeking to get on with the implementation of the new technology. And certainly the arrangement provided for by Congress has been effective. We do have an international satellite system operating.

The technology has certainly been developed over the last several years. And we do now have a global satellite communications system with earth stations being added around the world.

Now, your question, I think, raises the interesting possibility, that as we look on into the decade of the 1970's and perhaps at the 1980's, with the increased technological development and opportunities for satellite communications, should we permit other than COMSAT to orbit satellites? And certainly I would not today want to foreclose that possibility. I think that is a possibility that should receive appropriate consideration in due time.

Mr. MOSHER. You think it is conceivable that an organization like RCA or A.T. & T. or ITT might want to get into that business?

Mr. HAWKINS. Yes.

Mr. MOSHER. In competition with COMSAT, or supplementary to COMSAT?

Mr. HAWKINS. It might well be in the public interest, conceivably, as we look ahead to the enormous developments that will be possible through satellite technology.

Mr. MOSHER. And would this perhaps be more possible as a matter of public interest that there would need to be competition in the operation of those satellites for domestic communications, rather than international communications?

Mr. HAWKINS. Well, I think when we open up the domestic problem, we open up a number of additional considerations. I mean, here this is a matter now that has been receiving extensive study among the interested agencies and departments of the Government, and at this point in time it would appear that the most expeditious way to get on with the domestic satellite system is to at least get one system up operating in orbit.

There are then economies of scale to be achieved at that point. A domestic satellite with 12 or 24 transponders in it would certainly be more cost effective than a series of small satellites.

So that at this point in time, regardless of who owns it, whether it is owned individually or owned jointly, it would appear that the most effective solution for the moment at least would be to permit realization of the economies of scale that are possible at this point in time.

Mr. MOSHER. Well, you say that would be the most effective solution at this point. Who would be the most likely operator of that most effective arrangement at this point in time?

Mr. HAWKINS. Well, we have had suggestions from different ones that they might be the operator. COMSAT of course has been active in this area, and would certainly be a carrier that should be considered. But I would think that in reaching such a conclusion, the FCC as the licensing authority would want to consider who else might want to come forward to make such a proposal.

Mr. MOSHER. There might be a request for offers or bids from RCA, A.T. & T., and ITT, the whole communications industry.

Mr. HAWKINS. This is certainly conceivable. You will recall that some years ago the American Broadcasting Co. actually proposed that it be permitted to put up a dedicated satellite for television transmission.

Mr. MOSHER. I am completely new to this. I am not aware of that at all.

Mr. HAWKINS. That was some years ago.

Mr. MOSHER. The American Broadcasting Co.?

Mr. HAWKINS. Yes. That was some years ago. And actually they proposed that it be permitted to orbit a satellite that would be used for video transmission and other television purposes.

Mr. MOSHER. So the likelihood of competition for that type of franchise is very real and fairly imminent?

Mr. HAWKINS. Well, I don't know that I could go so far as to say that it is either imminent or likely. But rather it is always a possibility.

Mr. KARTH. Mr. Hawkins, by virtue of your answers to Mr. Mosher's questions, are you implying then that the 1962 act does in fact restrict the use of satellites for domestic purposes to the COMSAT Corp.?

Mr. HAWKINS. No. We do not read the 1962 act as restricting the operation or ownership of domestic satellites to COMSAT alone. Though I do not have the act in front of me, as I recall a section at the very front, it merely says that—and I may not say this accurately, but the substance of it is that this act should not be deemed to preclude the use of the system for domestic purposes, but it does not clearly spell out, in our opinion, any congressional mandate that COM-

SAT alone has the right to own and operate all domestic satellites.

Mr. KARTH. And you recognize that there might be a difference of opinion between you on that point and COMSAT?

Mr. HAWKINS. Yes. I have read COMSAT documents which take a different position.

Mr. MOSHER. Well, Mr. Chairman.

Mr. KARTH. Mr. Mosher.

Mr. MOSHER. I suppose there would be some legislative history, too. You would think there would be some record of congressional intent in this, too.

Mr. HAWKINS. I might say this is a subject that has been rather extensively briefed in filings before the Federal Communications Commission by a number of entities in its inquiry on domestic satellite communications.

Mr. KARTH. Who has the authority in Government circles to interpret the 1962 act, so as to clarify that question and legally prove either RCA's judgment on this point right, or that of COMSAT as being right?

Mr. HAWKINS. Well, initially I would anticipate that such questions would arise before the Federal Communications Commission, and then whatever decision the Commission made would of course be subject to the usual appeals to the courts, and perhaps if necessary to the Supreme Court.

Mr. KARTH. But you think the FCC is the agency of Government that would make the initial determination?

Mr. HAWKINS. The initial determination, because it would be anticipated that such a question would arise as a licensing matter, and since it would arise as a licensing matter, then this question would initially be considered there, and it has of course been the subject of numerous comments filed with the Commission over the last year or two in connection with the domestic satellite communications matter.

Mr. KARTH. There was some doubt in my mind as to whether Mr. Plummer's organization, if I may call it that, might also have some responsibility.

Mr. HAWKINS. It could be anticipated that Mr. Plummer's organization would be involved.

Mr. KARTH. In determining policy.

Mr. HAWKINS. Yes, certainly Mr. Plummer's organization, I would anticipate, would be vitally concerned with any such determination of policy, and no doubt the Commission would want to take into account, too, the views or comments by Mr. Plummer's office or anyone else who could contribute.

Mr. KARTH. If Mr. Plummer's organization established the policy, is that subject to appeals to the courts, the same as if the FCC made that determination?

Mr. HAWKINS. This starts to get us into a rather deep question. I would like to answer the question the best I can.

Mr. KARTH. All right.

Mr. HAWKINS. It starts to get us into the rather deep question as to what Congress really meant in the Communications Satellite Act. I think in that provision which gives certain authority to the President over the application of the policies in the Communications Satellite Act.

And I think I would not be alone in saying that there may be some disagreement as to just where these lines are drawn. But in any event it ultimately gets back initially, I think, to the FCC, because FCC is the body which has to issue the license.

Mr. KARTH. Yes, but if policy has been established, then they just go about issuing the license, and I assume once the license is issued, then at least to whomever it is issued they are legally entitled to move forward, and it may be subject to appeal, kind of in an after the fact fashion, as opposed to before the fact.

Mr. HAWKINS. But you could foresee the possibility that there could be a disagreement between Mr. Plummer's office and the FCC as to what authorization should be issued.

Mr. KARTH. And if there was, whose organization would prevail?

Mr. HAWKINS. Well, I guess at that point it would probably have ultimately to be decided by the courts.

Mr. KARTH. I see.

Mr. HAWKINS. As the final interpreter of the act of Congress.

Mr. MOSHER. The courts are accustomed to trying to figure out what Congress meant.

Mr. HAWKINS. They are rather experienced at it.

Mr. KARTH. Mr. Symington.

Mr. SYMINGTON. Mr. Chairman, correlating some of yesterday's testimony with today's has added to my confusion. We had Senator Gravel from Alaska yesterday, and he addressed himself momentarily to the COMSAT Act. And he seemed to feel that COMSAT was delinquent in providing domestic service, and that this was no fault of the act itself, although he thought Congress minimized the importance of domestic service; but that there remained sufficient room in the act to provide appropriate domestic service, but that lack of FCC authorization was impeding the service that he expected from COMSAT.

Never was the question brought up that he could have got it from another source, nor did we discuss yesterday the RCA interests and activities in this field in Alaska.

I am wondering why he pins all his hopes on what COMSAT can do for him if in fact under the law and competitive opportunities, that other companies afford, he could have turned elsewhere. Can you explain that?

Mr. HAWKINS. Well, unfortunately I wasn't able to be here yesterday, so I don't know precisely what he had in mind there.

Mr. SYMINGTON. Well, may I ask you this? Is it your understanding that under this act a competitive opportunity exists for a number of entities to make bids to provide domestic satellite communications services, and that COMSAT is merely one of them?

Mr. HAWKINS. I think the question would have to be broken down into two parts. If the INTELSAT satellite system is going to be used to provide domestic service, then that is a satellite system that is owned jointly by COMSAT and many countries around the world.

And therefore, it would be COMSAT's role, to the extent that that satellite system is used to provide domestic service.

Mr. SYMINGTON. Is it your feeling that it was not the intention of Congress to provide INTELSAT with such an opportunity, and responsibility?

Mr. HAWKINS. No; I think that it is the other way. I think that the Congress intended to permit such a use for domestic purposes, but it did not foreclose the possibility of other means or other entities providing domestic service only.

Mr. SYMINGTON. Dr. Charyk testified that COMSAT has been ready and willing and even anxious to go forward with a domestic service system, that for the past 4 years they have wanted to do it, and he said the only obstacle was FCC authorization. I believe that is what he said.

It seems to me another obstacle would have possibly been the competition that you or colleagues of yours in that field might have provided, in an effort to get such authorization for themselves. Wouldn't you have thought that? Don't you think that that would be an obstacle to domestic service by COMSAT. You are interested in providing it?

Mr. HAWKINS. Well, except for the ABC application, I can't recall at the moment that any other applications have been before the Commission offering to provide a domestic system. And we do get back to the fundamental question that any domestic satellite system of course has to be authorized by the Commission. And while I can't here today speak for COMSAT, I do know that COMSAT has endeavored over the last couple of years to move ahead with the domestic satellite system, which, of course, is a development that it would naturally be interested in as a follow-on to the work that it has been doing through the INTELSAT organization.

Mr. SYMINGTON. Well, have you been seeking, has your organization sought similar opportunities?

Mr. HAWKINS. We have not applied for such authority.

Mr. SYMINGTON. And may I ask why?

Mr. HAWKINS. Well, first, let me say that RCA Global Communications, Inc., is an international carrier. It is engaged in international communications, and we are involved in that phase of the business, and we have not made application to the Commission for authority to operate a domestic satellite system.

Mr. SYMINGTON. Mr. Chairman, I think I have to cease and desist here until I learn a little more about this subject.

Mr. KARTH. Thank you, Mr. Symington.

Mr. Hawkins, throughout your testimony here, you have talked at some length about your plans for the Alaskan communications system.

Mr. HAWKINS. Yes.

Mr. KARTH. And somewhat in line with the questioning that has gone on, as to authority to operate satellites for domestic purposes, do your plans include the possibility of launching a satellite to enhance that system, COMSAT notwithstanding?

Mr. HAWKINS. We included the possibility. We have looked at perhaps three possibilities. One, of course, is a dedicated satellite system for Alaska. Another possibility is some use of the INTELSAT satellite, a transponder, say, with a spot beam on Alaska. And of course the third possibility would be a portion of a domestic satellite that might be illuminated toward Alaska.

These possibilities have all been looked at; but here again, Mr. Chairman, being practical communications people, we would also have to look at the question from the standpoint of economics. And certainly the cost of a dedicated satellite for Alaska would greatly increase the

cost of providing a system there, as compared to getting, say, one or two transponders in a 12- or 24-transponder satellite that might be used, and since it is our interest not only to provide the best possible service but also to provide it at the lowest cost to the public, we would naturally be very interested in what approach would best achieve that objective.

Mr. KARTH. Well, could you cover the 48, plus Alaska, with one satellite?

Mr. HAWKINS. Well, a large satellite could.

Mr. KARTH. Within the present state of the art of technological development?

Mr. HAWKINS. You could do one of two things. You could of course use a specific satellite with a spot beam on Alaska; or a properly positioned U.S. domestic satellite, I mean for the lower 48 could also serve Alaska. It gets to be a question of the position of where the satellite is placed in orbit, and where the antenna is directed.

Mr. KARTH. Well, I think someone said yesterday that this could not be achieved with one satellite, and I was just wondering what your judgment was about it.

Mr. HAWKINS. I suppose what you are saying here is everywhere from Puerto Rico to—way out in the Aleutian chain.

Mr. KARTH. No.

Mr. HAWKINS. That would probably not be possible.

Mr. KARTH. I am talking about the lower 48, plus Alaska. Could one satellite do this?

Mr. HAWKINS. Well, I'd have to take a look at the exact calculations on this, but it is foreseeable it could get to be marginal between far out in the Aleutian chain and certainly the east coast of the United States.

Mr. KARTH. On page 3, you mention figures, the purchase of the ACS from the Air Force for $28½ million. What portion of that $28½ million was to be for the establishment of a satellite communication system as opposed to existing terrestrial facilities?

Mr. HAWKINS. The $28.4 million does not involve satellite communications.

Mr. KARTH. Pardon me?

Mr. HAWKINS. The $28.4 million covers only the existing ACS system, which does not include any satellite communications facilities.

Mr. KARTH. Well, I know that.

Mr. HAWKINS. Yes. Perhaps you are referring to the $27.6 million.

Mr. KARTH. Maybe the $27.6 million, yes.

Mr. HAWKINS. Yes. OK. With respect to the $27.6 million, initially, of course, there is about $3.2 million in there for a 50 percent interest in the Talkeetna earth station, plus the connecting microwave link.

Mr. KARTH. Is any part of this $56 million total considered to be moneys for the purchase of the franchise, if that is the proper word, as opposed to moneys to purchase existing facilities, and expanding facilities and improving services?

Mr. HAWKINS. Well, the entire $28.4 million is for the purchase of physical facilities and plant. This includes toll switching centers. It includes certain microwave systems.

Mr. KARTH. So you haven't really paid anything for a franchise as such. The word has been bandied about and that's the reason I ask the question. You paid $28.4 million for existing facilities that were judged to be worth $28.4 million. Right?

Mr. HAWKINS. The $28.4 million, in essence, was the price for all practical purposes fixed by the Air Force.

Mr. KARTH. For existing facilities?

Mr. HAWKINS. Yes. Now, in the bidding process, it was set up in a unique way, which said, in effect, you are going to win or lose, depending on what you offer for the purchase.

Now, I couldn't say that there is any specific sum of money in there that you could identify as such for the purchase of franchise, because it doesn't work quite that way.

Mr. KARTH. I was just wondering whether or not you felt you had purchased anything other than that which did physically exist there.

Mr. HAWKINS. Oh, yes; definitely, and that's what I was coming to. We felt that we have purchased not only the physical facilities but the business, and I believe this is borne out by the legislation, because in the implementation of this program for service improvements and rate reductions, for the first few years of operation there will be no profit from the operation. In fact, the first few years we will probably be losing money. So to that extent you might say Mr. Chairman, that you are being encouraged to make an investment for the future, in acquiring a business.

Mr. KARTH. But you don't feel that in that purchase price you have in fact purchased the exclusive use of the communications system up there? Other than the fact that you did pay for whatever existing facilities are there.

Mr. HAWKINS. We feel that we have acquired the existing business, and facilities of the ACS, in Alaska.

Mr. KARTH. But no exclusive right to involve yourself in such business, other circumstances notwithstanding.

Mr. HAWKINS. Well, the ACS is the only long-lines operator in Alaska today.

Mr. KARTH. I understand that. But that is a physical facility.

Mr. HAWKINS. It is a physical facility and also it is a business.

Mr. KARTH. It is a business, yes.

Mr. HAWKINS. It is the only one that's in the business. Now what we are saying here is that because of the nature of that business which was acquired and because of the economics and other public interest aspects of the business, it ought not to be fragmented or split up, at least at this point in time.

Mr. SYMINGTON. Mr. Chairman.

Mr. KARTH. Mr. Symington.

Mr. SYMINGTON. Something is dawning on me now. If COMSAT got the authority to provide satellite service to Alaska, you would consider that a fragmentation of the communications system of which you have invested to date, right?

Mr. HAWKINS. Not necessarily. It would depend on how it was done.

Mr. KARTH. But you do have a reservation about your answer to that question?

Mr. HAWKINS. Well, let me say it is a general question, and it is kind of hard to answer it as a general answer. Take the Talkeetna

earth station for example. In the Air Force RFO, the Air Force had already recognized at that point in time, and COMSAT had been authorized to go ahead with the construction of the earth station. But we certainly expect to have at least half the ownership of the earth station when this matter is resolved.

Mr. KARTH. If the act doesn't give COMSAT the exclusive interest they think they have for use of satellites in domestic communications, why would you feel that under any circumstances you would have this exclusivity?

Mr. HAWKINS. I am not saying we should have the exclusivity.

Mr. KARTH. In the State of Alaska.

Mr. HAWKINS. In the domestic satellite field.

Mr. KARTH. All right. That answers my question.

Mr. SYMINGTON. And it raises my next one, which is that in answer to my question "Why have you not asked for domestic authorization," you said that "We are principally international." But you have made and are interested in making further applications for Alaskan service. So do I take it that you consider that international in nature, as against domestic?

Mr. HAWKINS. No, I wouldn't say that. I would say actually that most of the service out of Alaska is either between Alaska and the lower 48, and/or within the State of Alaska.

Mr. SYMINGTON. What kind of service is it between the lower 48 and Alaska? Is that domestic?

Mr. HAWKINS. Well, about 80 percent of the business of the Alaska communications system is telephone business. And between Alaska and the lower 48, I believe this would be regarded as domestic communications.

Mr. SYMINGTON. So that, in effect, you are interested in domestic.

Mr. HAWKINS. That's correct, yes.

Mr. SYMINGTON. And you would qualify your previous answer to me, at least insofar as it affects Alaska. I think the record will show that I did ask you why you had not made the same kind of domestic application that COMSAT had made, and you replied it was because "we are an international service," I believe.

Mr. HAWKINS. I am not sure I said it was because we were. I think I said, instead, that we had not chosen to make such an application, and I merely added as a footnote after the fact statement. But I did not mean to imply that that was the basis on which we made the decision.

Mr. SYMINGTON. Mr. Chairman, I believe yesterday there was a statement that a single satellite could provide lower 48 service and a beam to Alaska. I noted that earlier you said that there was testimony to the effect that more than one satellite would be needed.

Mr. KARTH. It might have been in private conversation that this point was made to me, I am not sure. But I do know that that statement was made to me, either on the record or in private conversation.

Mr. SYMINGTON. The reason I mention it is because I think it was COMSAT's position that they could provide what I think we can now call domestic service between Alaska and the United States, with a single satellite. And I take it that Mr. Hawkins agrees that that is possible.

Mr. HAWKINS. Oh, yes; technically certainly you could provide domestic service between the lower 48 and Alaska with a single satellite.

Mr. SYMINGTON. Wouldn't a system that provides international satellite communications be more likely to be able to provide that kind of domestic service more cheaply, because of the unit cost.

Mr. HAWKINS. Well certainly I think that's a good point, because we are in a technology where there are certain economies of scale that can be realized through larger systems.

Mr. SYMINGTON. I would say here, Mr. Hawkins, that I don't really know a great deal about your international service, or the opportunities satellites might provide, so I am really asking these questions in a general way.

Mr. HAWKINS. All right.

Mr. SYMINGTON. I guess when I speak of an international service, I speak of yours as well as theirs. But I am just anxious to learn as much as I can about how to provide service to American citizens at the lowest possible cost who want to communicate anywhere in the world, certainly with their fellow citizens, and beyond as well.

Thank you.

Thank you, Mr. Chairman.

Mr. KARTH. There are one or two questions I would like to cover quickly. On page 3, you say RCA Globcom's commitment to the people of Alaska includes rate reductions averaging over 9 percent for interstate service, and nearly 40 percent for intrastate service. Does this suggest that the Air Force has been overcharging the Alaskans for domestic service?

Mr. HAWKINS. I wouldn't say that.

Mr. KARTH. What does it mean?

Mr. HAWKINS. First, let me say that traffic volume is increasing in Alaska, and we are looking toward improving the facilities, and we are anticipating a growth in traffic volume from the time we take over to a period that will justify these reductions in rates.

Now, this has not always been the case in the Alaska system in the past. And indeed, the Air Force itself has just on December 1 of this year actually put into effect most of the rate reductions that we had proposed, and which we had scheduled for on the takeover date. So that the Air Force now is really applying these rates for all practical purposes in Alaska.

Mr. KARTH. On page 5, you list a number of services, and you identify them by preceding them with a dot, and I think there are six general categories. Do any of those categories include the use of technology that would be direct broadcast in character?

Mr. HAWKINS. No.

Mr. KARTH. How long in your judgment would it take for that technology to arrive?

Mr. HAWKINS. Well, this is one in which I believe the scientists and engineers can certainly disagree, but that direct broadcasting technology is certainly some years ahead in the next decade. I would find it difficult to be precise as to when that would occur, because if you look ahead it means such things as very powerful satellites, it means development of small antennas of the kind that a person could have in conjunction with their own television set at home. So that development certainly is some years away.

Mr. KARTH. But if you had direct broadcast to small communities as opposed to each individual receiver, that technology is not as far down the road, is it?

Mr. HAWKINS. This is correct. In other words you come into a distribution area, and then redistribute from there.

Mr. KARTH. Yes.

Mr. HAWKINS. Yes, that should come first.

Mr. PETTIS. Will the gentleman yield?

Mr. KARTH. Yes, Mr. Pettis.

Mr. PETTIS. What does it take to translate the primary reception to the secondary receiver?

Mr. HAWKINS. Do you mean locally?

Mr. PETTIS. Yes.

Mr. KARTH. Existing lines.

Mr. HAWKINS. It would take existing cables or local distribution systems like CATV systems or something of that kind.

Mr. PETTIS. But that technology exists today.

Mr. HAWKINS. Yes.

Mr. PETTIS. So actually you could do that in the community.

Mr. HAWKINS. Yes.

Mr. PETTIS. These people we listened to yesterday were talking about some of these communities in Alaska. I think they said communities of over a hundred people, but fewer than a thousand. Now, you could have a primary receiver in some of those communities, of 400 or 500, or 600 people, and then redistribute from there; could you not?

Mr. HAWKINS. Yes. For example, this is a development down the road a ways but you could have, say a receive-only antenna there. That might be suitable for reception of television. And then some other arrangement for whatever small amount of ordinary telephone or telegraph service that might be required. But that certainly would be distinguished from a development that would mean that every house, every individual in that small community could have his own antenna and receiving set. I believe that was the question that the chairman had asked.

Mr. KARTH. Yes. The technology to broadcast to the community, and then using existing community facilities to distribute the signals, whatever they might be.

Mr. HAWKINS. That is right.

Mr. KARTH. To transmit to individual homes, that technology is here today, would you say? Or at least there are no technological breakthroughs required to accommodate such a system?

Mr. HAWKINS. Now here again it is a question of economics and cost. And further development is necessary to develop the most cost effective solution for that requirement.

Mr. KARTH. But at any rate whatever technologies are required in either of those two instances we have talked about, they could be advanced considerably by the expenditure of greater amounts of funds on the part of the research and development agency of the Government, would you agree with that?

Mr. HAWKINS. There is always opportunity for further development and advancement of the art.

Mr. KARTH. Just one last question, and then I think we ought to get to the next witness.

On page 9, beginning of the second paragraph, you say you want to stress that all of these activities and many others are going forward now, even though the regulatory steps which must precede the purchase of the Alaska communications system by RCA Alascom have not yet been implemented by FCC and Alaska Public Service Commission. Time is extremely short, et cetera. You seem to express dissatisfaction, and I am just wondering how strong your dissatisfaction is, and what specific delays caused by whom have made you dissatisfied.

Mr. HAWKINS. Well, we, of course, understand and appreciate the problems of the FCC and the regulatory agencies. Perhaps my feelings might best be described as impatience, rather than dissatisfaction. We have a big job ahead, we are very anxious to get on with it, we are looking at a July 1 target date, and we know in order to achieve that target date we need to have the uncertainties removed so that we can go ahead with confidence.

Mr. KARTH. Thank you very much, Mr. Hawkins. The committee has been benefited greatly by your testimony, and we are grateful to you.

Mr. HAWKINS. Thank you.

Mr. KARTH. The next witness is Mr. Richard Hough, who is vice president, Long Lines Department, American Telephone & Telegraph Co.

Would you, Mr. Hough, please proceed with your prepared statement?

## STATEMENT OF RICHARD R. HOUGH, VICE PRESIDENT, LONG LINES DEPARTMENT, AMERICAN TELEPHONE & TELEGRAPH CO.

Mr. HOUGH. Yes, Mr. Chairman.

I am very happy to have the opportunity to be here, and it is my objective to be as helpful and informative as I can.

I do have a short statement, and I shall start by reading that.

It is important to keep the satellite as communications medium in perspective. Communications satellites comprise a facility for transmission identical in function to microwave radio systems and coaxial cables. They have been proved to be an effective medium for transmission of intercontinental communications, as demonstrated by the extensive progress made in the implementation of the global satellite system.

However, there are no communications services which could be offered by satellites which cannot now be offered over terrestrial facilities. In recent years there have been other new developments in communications which are also of great significance in microwave radio and coaxial cables.

Looking to the future, waveguides and lasers also appear to hold great promise for carrying large volumes of communications at very low cost. Accordingly, a possible domestic communications satellite system must be considered as a part of a highly developed nationwide network and in comparison with other attractive transmission media.

A communications satellite may be regarded as an intermediate amplifier between two earth stations. It is thus in effect a microwave radio relay station on a very high tower. As such, it has some ad-

vantages, and some disadvantages, in comparison with terrestrial microwave radio facilities and coaxial cable systems. In like manner, of course, microwave radio and coaxial cable have various strengths and weaknesses when compared with each other.

Before comparing the characteristics of the different types of facilities, it is important to say that in the Bell System we feel strongly that it is highly desirable to use a diversity of facilities to meet communications requirements. In the international field, we have urged, and are continuing to urge, that the provision of circuits by satellite and by underseas cable be balanced so that service will not be catastrophically affected by the failure of a major facility and to insure continuing research and development work in both.

Similarly, in the domestic field, a diversity of facilities is also vital to insure service continuity. In the domestic network, there is at present a great diversity because both radio and cable systems are provided over many different routes. Nevertheless, the added diversity of facilities which would be offered by a domestic communications satellite system could be an attractive feature.

It should be pointed out that there are important differences between overseas communications and domestic communications which affect the relative attractiveness of different types of facilities. Overseas communications basically involve the transmission of messages over long distances, mostly over oceans, with no intermediate "drop off" points.

The domestic network, on the other hand, is an immensely complex system of interconnected cables and microwave routes, optimized as to cost and reliability, picking up and dropping off traffic at thousands of intermediate points across the country. In addition, the average length of haul of domestic messages is about 500 miles, which, of course, is far less than that of overseas messages.

In comparing communications satellites with domestic terrestrial communications facilities the considerations just outlined have a direct bearing on the question of costs. Since the costs of earth stations and of satellites are the same whether the earth stations are close together or far apart, the satellite is at a disadvantage at short distances.

Thus, the cost comparison most advantageous to satellites would be over a transcontinental route, such as New York to Los Angeles. At one time it appeared that the upcoming new generation of satellites now expected to be operational in 1971 or 1972, that is the INTELSAT IV series, would offer some cost savings over terrestrial systems for traffic of transcontinental distances. However, more recently there have been dramatic advances with respect to both microwave radio and coaxial cable along with significant increase in satellite system costs which have changed the situation.

The upcoming INTELSAT IV will have a capacity of about 9,600 voice grade circuits. However, there is now in service the L–4 coaxial cable, which has a capacity of 32,400 voice grade circuits. And in the same timeframe as INTELSAT IV, there will be installed the L–5 coaxial cable, which will have a capacity of 90,000 voice grade circuits.

Even on transcontinental routes it now appears that the cost per circuit mile of the L–4 and L–5 cables would be substantially less than that of INTELSAT IV satellites. As circuit requirements increase, L–4 routes can readily be converted to L–5 at even lower cost.

The high rate of growth of interstate messages plus the ability, with coaxial systems, to drop and pick up circuits at many points across the country and to reuse the same channel many times between different points have made economically feasible greatly increased use of coaxial systems.

With respect to microwave radio, within the past 3 years a method has been developed to double the capacity of TD–2 systems, the backbone microwave radio facility in the United States, so that a total of 12,000 voice grade circuits may be derived on each route. The cost of deriving the additional 6,000 circuits on the existing TD–2 network is very low indeed, and is very much less than the circuit-mile cost of satellite systems.

However, in spite of this cost comparison, we believe that there is a potential for the use of satellites in domestic communications. While the economics of satellites for domestic uses are not attractive at present, experience in the development of other communications systems indicates that with improvements in the art and careful integration in the network, satellites may also become an attractive facility for domestic use. Research and systems planning are continuing at the Bell Telephone Laboratories looking toward high capacity satellite systems operating in a range of frequencies as high as 30 GHz.

If the cost disadvantage can be minimized, there are certain operational advantages which could be gained by introducing satellites into the network on selected routes as an additional major type of domestic communications facility. Communications satellites are vulnerable to different types of failures than are terrestial facilities and have different transmission problems, the problem of delay being an important one.

A satellite is a complicated piece of machinery located so no one can reach it if it develops trouble, but, on the other hand, unlike a cable, a satellite is not subject to being cut by a construction contractor, nor is a satellite subject to signal fading due to atmospherics and certain other transmission problems which affect microwave radio.

Thus, as stated above, satellites could provide desirable diversification of facilities. With new high capacity systems such as the L–5 cable being introduced, and with cable and radio systems of even greater capacity planned, it is important to have adequate capacity available for restoration should it be needed.

Furthermore, communications satellites could provide a flexible means for rearranging large groups of circuits. Assume that calling patterns developed so that the peak load between New York and Miami was evening residential calling, but the peak load between New York and San Francisco was day time business calling.

If the ground stations were appropriately located, large groups of circuits transmitting between New York and San Francisco in the day could be redirected to New York-Miami in the evening with relative ease. We are currently studying these possibilities to determine just how satellites might be advantageously integrated into the nationwide network.

I have tried briefly to give you our current views regarding possible uses of satellites for domestic communications. As you can see, there are some problems, principally the cost disadvantage associated with the use of satellites at their present stage of development.

However, as I have indicated, in the Bell System we have the question of the use of satellites for domestic communications under close study at the present time. Their potential as a part of the domestic communications network can only be realized through very close engineering and operational integration with this network.

We perceive no barriers, legal or otherwise, which would prevent us from owning and operating a satellite system for domestic communications, subject, of course, to the jurisdiction of the Federal Communications Commission. We intend to pursue our work in the satellite area with a view to integrating satellites into our network as soon as they will help us to achieve operational benefits for our customers.

We and others in the private sector are able and willing to provide whatever research, development, and implementation are needed in the field of domestic communications, including communications by satellite. In view of this, the A.T. & T. Co. believes the wisest public policy at this time would be to permit any organization or group interested in establishing and operating a domestic satellite system to apply for a license.

Authorization of such systems should be determined on the basis of the most appropriate usage, in the public interest, of the available frequency spectrum and orbital space, as well as other relevant technical and economic considerations. In addition, any grant should be made with the understanding that no segment of the communications using public would be forced to subsidize such a system.

Mr. KARTH. Thank you very much, Mr. Hough, for your excellent statement. The chair wishes to recognize Mr. Mosher.

Mr. MOSHER. Mr. Chairman, if I understand Mr. Hough's testimony, he is saying that A.T. & T. is very actively considering the use of satellites and does expect to be in the satellite business at some point. You lay a heavy emphasis on the fact that satellites must be considered as part of an integrated system.

Several times in your testimony you emphasized that satellites are only one of several means, there are microwave towers, and cables, and so forth, and that you are really interested in satellites at this point not so much in the potential economies that might result as the fact that they might help to insure service continuity. You used that phrase at one point. And therefore, it would seem that your prime interest in satellites is as just one more element in the technology that insures continuity of service. At this point the economies through satellites are questionable.

Mr. HOUGH. Yes, sir.

Mr. MOSHER. But you certainly are pushing in that direction.

Mr. HOUGH. Yes. And I am looking at things that can be implemented now, and in the reasonable future.

Now, as Mr. Hawkins indicated, no one is sure what will be around the corner in the 1980's and beyond, and you can recall I mentioned that the Bell Laboratories are looking at some forward-looking types of systems, employing higher frequencies and much higher capacities than anything we have talked about.

So if I had to guess, I would say there would be some economically attractive possibilities for satellites, sometime in the quite forward-looking future, not in the immediate future.

Mr. MOSHER. And regarding those possibilities, A.T. & T. certainly reserves its right to put up its own satellites?

Mr. HOUGH. Yes, sir. As you have correctly indicated, in the near future it may very well be attractive to use satellites to provide this diversity of facilities and reliability, which is tremendously important to more and more communications, and the reliability is of critical importance to a lot of business and private operations in the country.

Mr. MOSHER. You don't see much future for the use of satellites and ground-based stations without using them in conjunction with your cables and your microwave system?

Mr. HOUGH. No, sir. As a practical matter, of course, satellites alone provide no service. They must link with terrestrial facilities to connect to the ultimate user. So in any case there has to be some integration with terrestrial facilities, and it is important to study communications for this country as an overall integrated system, having the possibility of using all kinds of facilities, whatever they might be, and satellites certainly are one of these.

Mr. MOSHER. No further questions, Mr. Chairman.

Mr. KARCH. Mr. Symington.

Mr. SYMINGTON. When you say "this country," Mr. Hough, would that include Alaska? For example, could terrestrial technology compete economically with satellite service there?

Mr. HOUGH. Well, I would think in providing service to Alaska, terrestrial technology and satellite technology should be complementary, rather than competitive. And as Mr. Hawkins has indicated, and I fully support his view, that it is important that communications for Alaska be engineered and planned on an overall integrated basis, using all technology that is available.

Mr. SYMINGTON. But you wouldn't feel, would you, that an exclusively terrestrial service to Alaska would be feasible, given the state of the two arts?

Mr. HOUGH. Well, let me put it this way. I think the service needs to be integrated with the lower 48. Terrestrial service is available to Alaska. And referring to the comments of Senator Gravel and Mr. Pollock yesterday, I was surprised when they indicated a shortage of circuits to Alaska, and I checked that yesterday and we have had no shortage of circuits to Alaska for some time.

So there is service between the lower 48 and Alaska.

I would suspect in developing a system for Alaska, satellites would figure prominently in the consideration.

Mr. SYMINGTON. If your organization had the franchise to provide intrastate terrestrial service in Alaska, would you feel it imperative that you would also control any satellite communication assistance to that system? Would you consider it awkward to have a split in ownership and control there?

Mr. HOUGH. Well, I think the important thing is to be able to do an overall, integrated planning and systems engineering job, so that you can lay out a system that will provide the best service at the lowest cost. Of lesser importance is exactly where you get those facilities, but you must have substantial control over them if you are going to be able to operate that system in an effective way.

Mr. SYMINGTON. You heard the testimony of Mr. Hawkins concerning any requests similar to that of COMSAT, for FCC authoriza-

tion to operate a domestic communications service. Has A.T. & T. made any such request?

Mr. HOUGH. We have made no formal application before the FCC. You will recall that the FCC had a domestic satellite investigation under way, and we made filings in that, as did a number of other interested organizations, and we are all awaiting the outcome of that, from the FCC. But we have no formal filing.

Mr. SYMINGTON. Mr. Hawkins, at least in a footnote to one of his answers, suggested that his organization was international in its emphasis. How would you describe yours?

Mr. HOUGH. We operate both internationally and domestically, but of course by far the larger portion of our business is the domestic. There just are more domestic communications.

Mr. SYMINGTON. Do you foresee the use of satellite assistance to your communication network?

Mr. HOUGH. As I indicated, we are studying that very hard, and we feel that satellites will have a part in our network. But to make them effective and justified, we are going to have to integrate them very carefully with the network as a whole, to optimize the overall service and cost factors.

Mr. SYMINGTON. Thank you.

Mr. KARTH. Mr. Pettis.

Mr. PETTIS. If I might turn, Mr. Chairman, to another facet of this question which we touched on very briefly yesterday, and that has to do with programing. One of the big problems we have in our society today is getting important educational material where it really belongs, whether we are talking about children, preschool, Headstart, or even in sophisticated areas of, let's say, heart surgery. Many of the doctors of the world in many countries haven't the faintest idea about how to go about this. And I read yesterday of a team of American physicians that went to another country to teach the doctors of that country how to do heart surgery.

While they were there, they had closed circuit television, this was video taped, and they will continue to use this, and apparently it made a great impression on the people, but more than that, it helped the people of that country to upgrade its medical care.

Here we have this new facility, or apparently we are at least on the threshold of something that might be used educationally. Now to come back home to our own country, I am told by educators that one of our great needs is to find enough teachers, say, in some of these States of ours, whether in the South or in the northern area, where populations do not support strong educational programs. I am just wondering, dreaming a little bit, if there aren't some possibilities here for cooperation between organizations such as yours and the Government, which is interested in upgrading the education of its people, and using some of these things like satellites, to help us in this program.

Now, I think we have proved that we can teach youngsters without having a live teacher there, if we can bring the audio visual image in, and have the teacher somewhere else. We can accomplish a great deal. Maybe my question should be put this way: Don't satellites lend themselves, or won't they one day lend themselves to this kind of educational endeavor?

Mr. HOUGH. Well, they are one facility that certainly can be used. I think satellites are attractive when you have one program that you want to distribute to a very wide area. Certainly they can look attractive there.

On the other hand, if you consider within a State, we have worked with a number of the States on their educational television programs, and some of them have rather extensive distribution networks. Some of the States own their own. We furnish service to some of the States.

I think you will find, if you look at the economics of it, for these situations, that terrestrial facilities are far more economical for this purpose than would satellites be.

The problem is that when you come down to earth to receive a program, it takes a pretty substantial receive-only station. You can't afford to have one of those on every school or perhaps at ever university, so you end up with a sizable terrestrial network to distribute from the station, and by the time you add up all the costs, they become high.

But again I would emphasize that there is no service provided by satellites that can't already be provided by terrestrial facilities. So it is purely a matter of what is the most economical way of doing the job, and you have to look at each situation as a system.

Mr. SYMINGTON. Will the gentleman yield.

Mr. PETTIS. I yield.

Mr. SYMINGTON. Why do you suppose, then, that Senator Gravel put so much stock in satellite assistance to Alaska's communications network? Why isn't he equally interested in what terrestrial communications technology could do?

Mr. HOUGH. Well, let me make two points there. First of all, I am talking mainly about the lower 48, where much of the communication is between relatively short distances, and even when you communicate between points that are quite far apart, you want to drop off some of it along the way.

Now, when you come to Alaska, there are wide open spaces, and when you take communications long distances for a few people, small volume, the cost is high. The cost is high whether you do it by terrestrial facilities or by satellite facilities, But the technology is there to do whatever you want. It is just a question of cost.

Mr. KARTH. But it would probably be higher by one method than the other.

Mr. HOUGH. It is just a question of what price you want to pay. I suspect that in some instances it will be advantageous to do it by satellite. In other instances, it will be advantageous to do it by terrestrial facilities, and any system you come up with must be a carefully thought out and engineered combination of both.

I also have the view that a satellite system for Alaska alone would probably be prohibitively expensive.

Mr. SYMINGTON. And you would agree, then, with the suggestion that satellites serving the lower 48, with a beam to Alaska, would be the way to provide satellite service?

Mr. HOUGH. Yes. I would also caution, however, and I think Mr. Hawkins made this point, that in order to cover both Alaska and the lower 48, there would have to be some sacrifice. In other words, in addition to having a separate antenna beamed on Alaska, the location of

the satellite in orbit would be a compromise. So you would have something less than you like for the lower 48, from the standpoint of signal strength and the number of circuits you can carry. But this would be the economic way of doing the job, if you are to use satellites.

Mr. SYMINGTON. Nevertheless, a satellite serving Alaska would need other uses in order, in your view, to be economically feasible?

Mr. HOUGH. It would need other uses. As I have indicated, for it to be economically feasible as part of our network in the United States, it must be very carefully integrated with it, otherwise, the costs are going to be much higher than the costs of other facilities that could be made available.

Mr. SYMINGTON. Would you think, for example, if Canadian systems were linked to it, that that might help lower the cost?

Mr. HOUGH. I would like to caution one thing on the Canadian system. Canadians have told me—those participating and knowledgeable in their proposed system—that the circuits they obtain through the use of their proposed satellite system will cost them four times the comparable costs if they obtained them through installing terrestrial microwave facilities.

Mr. KARTH. You mean for the purpose of serving the same number of people? The same localities, regardless of how far separated they are?

Mr. HOUGH. The great volume of communications for which that satellite is to be used will be trans-Canada communications to the major population centers, and so this is the bulk of the communications requirement, and terrestrial facilities would cost them about a quarter the cost of these satellite circuits.

Now, when you talk about reaching these isolated outposts in the Northwest Territory, terrestrial facilities there would be very expensive. I don't know what the comparison is, but in any case they will be very, very costly communications.

Mr. KARTH. That obviously is what they are really interested in doing, isn't it?

Mr. HOUGH. That is one of the things they are talking about. But it is going to substantially increase the cost of the great bulk of their communications, if you see what I mean.

Mr. KARTH. I don't think there is any question about that. But it seems to me for the same service, to the same people, irrespective of how diversely they are located throughout Canada, under those circumstances, one method doesn't cost four times as much as the other, does it?

Mr. HOUGH. No, I won't say that. But I suspect the satellite application would be more costly.

Mr. KARTH. For the same service to the same number of people, spread all over the country?

Mr. HOUGH. When you think of them scattered all around, and when you are talking about a two-way communications service now, you need large major ground stations. These are costly, and when you start scattering substantial numbers of these around, the costs mount up very quickly.

Then you try to optimize by having fewer, and then you find yourself with substantial terrestrial facilities in order to interconnect.

But you have to lay out each particular situation carefully, and weigh it, to see just what the pros and cons are, and then you add up

the dollars and you see whether it is worth it to you or not. The thing I urge very strongly is that to consider that you can't talk of a satellite system or a communications system. You have to look at your objective, and do a thorough, balanced systems engineering job in order to minimize the cost and maximize the service.

You can't arbitrarily say one way of doing it is going to be better than another way. It is going to take a lot of ways to provide service to Alaska or Canada or any place you name.

Mr. KARTH. Undoubtedly you can't have one transmission system to the exclusion of the other and come up with any kind of a reasonable cost-benefit ratio.

Mr. HOUGH. That is right.

Mr. KARTH. In all probability, it is going to require a combination of the two.

Mr. HOUGH. That is right.

Mr. KARTH. And with that combination of the two, in proper balance, you can then effect substantial cost savings, I would assume.

Is that a correct statement?

Mr. HOUGH. That is a fair statement. You get the lowest cost if you do that proper balancing job. And of course you have got to decide where you are going to chop off, how far out are you going to provide all these services. The further you reach, the greater the cost per unit. It seems to me that has to be weighed along with all the other priorities for the use of dollars.

Mr. KARTH. I assume that in addition to Canada having to make that judgment, the same considerations are being used by France and Germany and the Soviet Union and other countries.

Mr. HOUGH. Well, I don't know of any serious consideration at the moment of domestic application within Germany and France, and as you know communications service in the Soviet Union are very limited.

Mr. KARTH. I think we all agree they need something.

Mr. HOUGH. Yes, but for example, a satellite for domestic use within France would be very uneconomical.

Mr. KARTH. Counsel points out that France and Germany are undertaking development of such a system together.

Mr. HOUGH. Well, there has been talk of regional consortiums, but it would have to cover much more territory than just France and Germany to be an economical way of providing service.

Mr. KARTH. Maybe they are considering selling these services to some other European countries.

Mr. HOUGH. Oh, yes. I think the French at one time were talking about using it for communication to French Africa, which begins to make it look somewhat more attractive. But this is sort of on the back shelf at the moment, and as you may know, the French have been putting cables across the Mediterranean to Africa as a better way of providing the service.

Mr. SYMINGTON. Mr. Chairman.

Mr. KARTH. Mr. Symington.

Mr. SYMINGTON. Something you mentioned in connection with the problems of a single satellite serving Alaska and the lower 48 would seem also applicable to serving France and Africa—namely, a compromise in the orbit. Would that be true?

Mr. HOUGH. Yes.

Mr. SYMINGTON. I regret that we have had no testimony from some of yesterday's witnesses on this question, but if such a compromise is required, let's say between the lower 48 and Alaska, it would seem to me that some benefit might be derived from including Canada or portions of it within that compromise, so that more people would be served by the same system. Would that be logical?

Mr. HOUGH. Yes, Certainly the more you load a satellite, the more the unit cost goes down on the satellite itself. On the other hand, the more places you try to serve, the more ground stations you have, the fewer services you provide per ground station, and so the cost goes up.

Also, the numbers of circuits that can be provided on the sorts of satellites that are in the development stage now are rather small compared to the circuit needs for domestic communications within the lower 48. And a compromise satellite system which would serve Canada and Alaska and provide some service to the lower 48 could very well result in the communications service for the lower 48 costing more than they would without it.

Mr. SYMINGTON. It would certainly be helpful, Mr. Chairman, sometime to get some testimony on this from witnesses engaged in satellite communications, or a chart of some kind explaining what in their view would be involved in expanding the coverage of a system serving the lower 48 and Alaska.

Mr. KARTH. I think the gentleman is right. It may well be the judgment of the committee that we should call additional witnesses or recall previous witnesses, and go into some areas that we had not contemplated earlier.

Mr. SYMINGTON. Thank you, Mr. Chairman.

Mr. KARTH. Mr. Hough, on page 1 of your statement, about in the middle of the page, you say, "However, there are no communications services which could be offered by satellites which cannot now be offered over terrestrial facilities." That is a rather all-inclusive statement.

Mr. HOUGH. Yes, sir.

Mr. KARTH. Certain other witnesses before this committee have indicated substantial disagreement with that statement. I suppose standing alone it may well be true. I am sure that you have given great thought to it and meant to make a very accurate statement.

But I think the broad capability offered by satellites, in conjunction with certain terrestrial facilities, of course, gives you broader capability. You can illuminate the entire Nation, for example, using a single satellite in such combination.

It seems to me that it is kind of a catchy sentence when it is put in that context. Wouldn't you agree that a combination of these two systems, within the 48, for example, would in fact offer the opportunity for broader capability, for illuminating the Nation, if you will, as opposed to transmitting point to point using terrestrial facilities exclusively?

You can transmit from New York to St. Louis, there isn't any question about it. You can go from New York to San Francisco; there isn't any question about that. But illuminating the entire Nation, the broad capability that you get from a satellite is something that you can't get by the exclusive use of terrestrial systems at this time; isn't that true?

Mr. Hough. I wouldn't agree with that, sir. What you are talking about, again, we keep confusing economics and service. When I say there is no service, there would be no new service provided with this broad coverage. What you would hope is that perhaps you might make some of these services more economically viable in some places, where they may not now be economically viable. So we are not talking about providing any additional services.

For example, yesterday, as I recall, Dr. Charyk talked about the capability of the satellite that they proposed to develop for domestic purposes, to provide 50 megabit per second capability. And that is good capability. But the L–5 coaxial system, a single tube, will provide about five times that bit carrying capacity.

Mr. Karth. For domestic service?

Mr. Hough. Yes. And so there are no new communications services. But what you hope by combining optimumally the various technologies is that you will be able to provide these services more economically, which means they can be afforded by more people and in more places for more things and that is the whole objective, is to provide more and better service for less money, and satellites provide a tool that need to have a good close look.

But at the moment, it is not clear at all that there will be any economies through this application. Even for the broad distribution that you are talking about, because down at this location where you want to use the signal, you have got to put in a pretty substantial installation. Maybe $250,000 to $300,000 for a receive-only station.

Mr. Karth. But if it could effectuate some economies, that is a very laudable purpose in and of itself, isn't it?

Mr. Hough. That is the whole name of the game, as far as we are concerned. We are anxious to use everything we can lay our hands on to provide the best service at the lowest cost.

Mr. Karth. So with the capability that you feel coaxial cables provide or will provide in the near future——

Mr. Hough. They are providing today. We have thousands of miles today.

Mr. Karth. Are providing today or will provide to an even greater degree in the near future, it appears to me that A.T. & T. would have little if any objection to competition, because after all it seems to me from your statement you have no fear of it whatsoever.

Mr. Hough. We don't have any fear of competition as long as we are able to compete on the same basis. And as I have said at the close of my statement here, and we have said before, we think that anyone ought to be permitted to apply for a domestic satellite system, if they think it can serve a good purpose in the public interest. And then let that specific proposed system be evaluated on its merits. We have had a great deal of talk about domestic applications and other applications, and what they will do. I think it is time that we got down to brass tacks and had some specific proposals, so that all can look at them and evaluate them in detail, for specific applications.

And we would expect at the proper time to have a proposal of our own.

Mr. Karth. Has that always been A.T. & T.'s position, that you have a mix of these two capabilities, the use of satellites in conjunction with terrestrial facilities?

Mr. HOUGH. Yes, it always has been our position that any application of satellites must be an integrated system with terrestrial facilities. We have always felt that.

Mr. KARTH. The economics notwithstanding—which is what, after all, the public pay—you would oppose a direct broadcast system, for example?

Mr. HOUGH. No, sir. I think we would look at any proposal that was made on its merits, and we would comment on it at that time, as we saw it. As far as a direct broadcast system goes, none has been proposed as yet, and it looks a ways into the future.

But if that appeared to be an economically viable thing, that some private entity wanted to go ahead with, why, we wouldn't necessarily oppose it unless it was inhibiting our ability to provide other service, such as interference, use of frequency spectrum we need for service and things like that. All these things need to be considered.

Mr. KARTH. Well, I don't feel that I want to get into the particulars because my ignorance of the subject doesn't allow me to. But I think for the record, if we can have any kind of agreement between those who are involved in the communications business, or are interested in furnishing technological advancements of the communications business, that A.T. & T. has no objections to a system, regardless of whether it is a combination competitive system or whether it is a direct broadcast system, that might sometime in the future be proposed by a company other than the one that you so ably represent.

Mr. HOUGH. Well, we would have no blanket objection to anything such as you mentioned. But again, we would want to look at each proposed system on its own merits, and evaluate it at that time. And I could conceive that we might object strongly to some proposals. Others we might not.

But we don't have any blanket objection to what you suggest.

Mr. KARTH. In the second paragraph of page 2, you state in addition to the average length of haul of domestic messages, about 500 miles—which of course is far less than that of overseas messages—you refer here to toll messages, rather than all domestic messages?

Mr. HOUGH. Yes. Intercity messages. Generally our toll messages are considered over 24 miles in length. We are talking about the intercity service here. Not the local telephone calls.

Mr. KARTH. Yes. On page 4, you conclude that the economics of satellites for domestic uses are not attractive at present. The statement appears to be, as I have already indicated, in some considerable conflict with testimony received before this committee.

So I wonder if for the record, within the next 5 or 6 days, you could provide a paper with some appreciable justification of that conclusion.

Mr. HOUGH. I would be very happy to. It will be no problem at all.

The types of services for which satellites appear to be best adapted are:

1. A heavy concentration of telephone circuits between two widely separated points.

2. Television program distribution to many broadcasting stations, where a single satellite could transmit to the whole of the contiguous 48 states.

Accordingly, the satellite system studied was configured to provide these two types of service. It consisted of two transmitting and receiving earth stations in the vicinity of New York and Los Angeles, respectively, each equipped with two 90 ft. diameter antennas; two satellites of the INTELSAT IV type, each providing 12 transponders; and 71 receiving only earth stations equipped with 30 ft. diameter antennas for television reception, spread throughout the United States except

in the northeast section where the density of broadcast stations makes satellite earth stations clearly more expensive than terrestrial interconnections.

Two of the 12 channels in each satellite were assigned to New York-Los Angeles telephone transmission (regular and protection) and the remaining 20 channels assigned to television. Even this number falls somewhat short of meeting requirements during football weekends when the networks are split into many sections carrying different games and different commercials. The receiving only (R. O.) earth station locations were selected so as to minimize costs by hubbing several broadcasting stations from a single R. O. station when the proximity of several broadcasters made this less costly than additional earth stations.

Based upon the present state of the art, the economic comparison favors terrestrial facilities as follows:

| | 1st cost | Annual charges |
|---|---|---|
| Satellite system | $154,900,000 | $48,900,000 |
| Terrestrial facilities | 114,000,000 | 34,200,000 |

In spite of the unfavorable economics shown in this study, it is possible that a domestic satellite system closely integrated with the terrestrial network could provide offsetting advantages by providing circuits on a time-shared basis to relieve peak traffic demands or as a backup facility. Further studies are being made to explore these possibilities. Also, it is entirely possible that advances in the art might result in a more favorable comparison.

Mr. KARTH. And also, in the third paragraph of page 4, you state that communications satellites have different transmission problems than do terrestrial facilities.

Mr. HOUGH. Yes.

Mr. KARTH. We assume that that is an accurate statement. I would ask that you provide for the record on this conclusion an evaluation of the problem of the time delay for satellites, and the attendant problems?

Mr. HOUGH. All right. I will be very happy to.

Mr. KARTH. I recall that at one time it was thought that geosynchronous satellites would never work because of the voice delay; that you just couldn't accommodate that situation.

I think we would like to have some statement from you on this.

Mr. HOUGH. I will be very happy to supply that.

Because of the distance of about 50,000 miles (up and down) traversed by the electrical impulses sent over a synchronous satellite, the time taken between the origination of a signal at one end and its appearance at the other is about three-tenths of a second. This long transmission delay affects both data and speech transmission over satellite circuits.

With respect to data, the long delay affects the efficiency of transmission when normal error detection and correction techniques are employed. In most error control systems a block of characters is sent to the distant end, checked there for errors, and a signal is then returned to the originating end, telling it either to repeat the last block or to proceed with the next. The usual transmission time of a block of characters over a voice band data channel is two to three seconds. The additional six-tenths second required for the error control process on satellite circuits reduces the overall efficiency of transmission by 20–30%. More sophisticated error control methods could be used to prevent this loss in efficiency. Two possibilities would be the use of more complex terminal equipment, with increased memory and buffer capacity, or the use of "forward acting" error correction techniques. Either of these would be more expensive than normal error correction arrangements.

The satellite transmission delay affects telephony because telephone systems all over the world operate on what is known as a two-wire basis: that is, the links to the customer's telephones consist of a single pair of wires which carries speech in both directions. Long distance facilities are generally "four wire"; that is, a separate channel is used in each direction of transmission.

At the junction of the four-wire and two-wire circuit facilities a reflection of electrical energy takes place which causes some of the incoming speech energy to be transmitted back in the opposite direction. On satellite circuits, if preventive measures were not employed, this reflection would cause an "echo" of his own speech to be heard by the speaker, delayed by six-tenths second (the round trip transmission time) from the time he spoke each word. An echo with such long delay seriously degrades "talkability", often throwing the speaker completely off stride.

To reduce the effect of such echoes, devices known as "echo suppressors" are employed at each end of the circuit. The function of the echo suppressor is to recognize the presence of speech from the distant end of the circuit and to insert a block to transmission in the outgoing direction, which is held long enough for the echo from the receiving telephone to die out. Echo suppressors are also used on terrestrial long distance circuits, but the extremely long delay time of satellite circuits (on transoceanic cable circuits one-way delay time generally runs to about 30 milliseconds or one-tenth that of satellites) presents some further difficulties. It is quite possible, and even normal for customer A to say something and for customer B also to make a sound in the three-tenth second interval before A's speech reaches and operates the echo suppressor at B's end of the circuit. The result is that the energy from B's sound goes through to the echo suppressor at A's end of the circuit and operates it, thus interrupting A's speech. This causes what is known as "clipping". Considerable time may be lost in back and forth transmission of bits of speech sounds as each customer tries to gain control of the circuit. With the type of echo suppressors available prior to 1965 this undesirable effect was very pronounced.

However, special types of echo suppressors have recently been designed to reduce the effects of clipping, principally by reducing the loss introduced by the echo suppressors when "double talking" takes place, so that each customer becomes aware that the other is trying to speak. Other means are under study. One of these is possible use of special "echo cancelling" devices in addition to echo suppressors but these are still in the laboratory stage. Any such devices, as well as the special echo suppressors, add to the cost of providing service, and since they must be applied on each individual telephone circuit, their cost multiplies directly in proportion to the number of circuits in use. These extra costs may be of little significance to transoceanic satellite circuits, but they are indeed significant in the domestic telephone field where thousands of circuits may be involved and the cost of competing terrestrial circuit facilities amounts to only two to three dollars per mile.

Even with the best known corrective measures that may be applied to satellite circuits, there will still be some inherent disadvantage resulting from the long transmission delay as compared with terrestrial circuits.

One further complication to the use of satellites domestically, is the fact that two satellite hops in tandem—such as might be encountered in connecting a cross-country satellite circuit to a satellite circuit to some overseas location—results in an overall round-trip delay in excess of one second, which is generally agreed world-wide to be unacceptable for commercial telephony. This is a further illustration of the need for the closest possible integration of satellite circuits into the planning and engineering of the overall communications network. Satellites simply cannot be dealt with in a vacuum and isolated from network planning if they are to be used effectively for telephony.

Mr. KARTH. Do you know how much your company spent on research and development in satellite communications prior to the 1962 act?

Mr. HOUGH. I couldn't tell you offhand, but I would be very glad to get that number for you.

Mr. KARTH. If you could provide for the record an answer to that; and also how much you have spent since enactment of the act.

Mr. HOUGH. You will recall, we developed and had launched, paid for the launching of the first communications satellite, Telstar, which was prior to the act.

Mr. KARTH. I would like for the record how much your company has spent in this area.

Mr. HOUGH. Very good.

Mr. KARTH. Both before and after the 1962 act. And if you can, how these expenditures compare with the terrestrial expenditure that you have made.

Mr. HOUGH. Yes.

Bell System research and development expenditures specifically related to satellite communications have amounted to approximately $79 million through 1969. Of this amount, about $62 million was spent through 1962, the year the Communications Satellite Act was enacted. An additional $17 million has been spent since that time. This work has been of substantial significance in the advancement of the art of communications by satellite and the application of satellites to the communication requirements of the Bell System.

Since World War II, the Bell System has spent a total of about $2¾ billion on research and development. It should be understood that this figure includes research, systems engineering, exploratory development and, by far the largest item, the specific development of equipment for manufacture by the Western Electric Company and use by the Bell System Companies. Much of the research and exploratory development expenditures have been in fields equally essential to satellite communications and other communications media. These include work on such things as transistors, solar cells, thin film and integrated circuit techniques, pulse code modulation and basic microwave transmission research.

Mr. HOUGH. One comment I would like to make there and will make it in the statement is that many of the areas in which we do research and development for terrestrial facilities are directly applicable to satellites. Solid-state work, transistors are certainly an example of that.

We wouldn't have satellites, communications satellites, without the transistor.

Mr. KARTH. But we tried to build one once and it didn't work very well, as I remember.

Mr. HOUGH. Yes.

Mr. KARTH. In the early days of communications satellites.

Mr. HOUGH. Yes.

Mr. KARTH. Then also, to give this committee a little better idea of what the mix might be, insofar as it pertains to Alaska, I wonder if you could provide for the record an answer to a question such as this: If you were the communications czar of Alaska, for example, how would you propose to serve the needs as envisioned by Senator Gravel and Congressman Pollock, who I assume were indicating people's desires as opposed to something else?

Mr. HOUGH. Well, let me say first we were not, as you know, one of those who bid for the ACS system, and we have made no study of communications in Alaska.

Mr. KARTH. I see.

Mr. HOUGH. And this is a very major study to do any kind of a systems engineering job.

Mr. KARTH. Well, you have drawn some rather illuminating conclusions, however, on that, and I was kind of surprised that you would not make a study.

Mr. HOUGH. Well, I am sorry to hear you call them conclusions. I would like to say I have given you some——

Mr. KARTH. Statements of fact?

Mr. HOUGH. I hope helpful views in answer to some rather general questions.

Mr. KARTH. I see.

Mr. HOUGH. And I think I have said over and over again that you can't really tell what the real pros and cons of costs and service and therefore facilities usages are until you do this overall system engineering job. And this is a job of major proportions.

So I am afraid we are just not in a position to give you an outline of what kind of a system we would put in Alaska. This is a very major job that we haven't tackled. I think RCA, who is tackling that job, is in a much better position to do this.

Mr. KARTH. Fine. Well, if you feel you can't respond to it, I certainly will accept that judgment.

Mr. HOUGH. All right.

Mr. PETTIS. Mr. Chairman, may I ask a question?

Mr. KARTH. Yes, please do.

Mr. PETTIS. And not just of Mr. Hough, but maybe of Mr. Hawkins. You know, I used to look forward a few years ago to General Sarnoff's prophecies. He used to come out once a year with a statement to the effect that in 10 years we will have this and this and this.

I wish these two gentlemen could look downstream to 1980 and try and anticipate a hearing such as this, and then tell us what the world will be like for the next 10 years. I know there is a temptation for management to be a little on the conservative side, in all of its projections, and that is probably very wise and prudent.

But there probably are some things that these men have been thinking about, and maybe speculating on for the next 10 years, in terms of what we have been discussing here in these hearings this morning, that we haven't brought out because we don't know what questions to ask, Mr. Chairman.

Mr. HOUGH. Well, that is a pretty broad question. I would like to take a crack at it, though, for you.

Mr. PETTIS. I would love it.

Mr. HOUGH. First of all, I think we must recognize in recent years, quite recently, there has been really a sharp upturn in the critical importance of communications to all phases of operation of this country, not only business but also on a personal basis.

And communications are no longer something that is helpful to business, or just saves them some money. They have become for many businesses something that is absolutely essential to their survival. They can't do business without it.

Some of them depend wholly on it. So that reliability of communications, the importance of it, has really escalated. And the critical nature of some of the applications have made the quality of communications critically important, and I see that trend continuing, so we are going to have to continue to do a better and better job from the standpoint of reliability and immediate availability and quality of communications.

Because of this increasing importance in the growth and the need for communications, the number of messages, however you measure it, is going to continue at a very high level.

Residentially, a long-distance telephone call is no longer a luxury, it is a necessity, as far as the individual person is concerned. So we see continued high growth.

And this means that we must continue to come up with facilities that will provide large capacity, and so I spoke of the 90,000-circuit

coaxial cable. Now we have coming along in the latter part of this decade, to meet the need, a waveguide system that will take about 250,000 circuits, a quarter of a million.

Looking further into the future, we look forward to the laser in tubes, and something in the ball park of a million and three quarters to 2 million circuits. And then the switching must come along with that, because we must provide a balance between transmission and switching, to get the lowest overall cost and the most flexibility.

Now, to be more specific, one of the areas that we are quite excited about is picture phone, and that will go into the first commercial service the middle of next year. We think this is going to grow quite rapidly, and this has a demand for large chunks of the spectrum.

By spectrum I don't necessarily mean that that is in the air, but it can be contained in tubes, whether they are coaxial or waveguide. As that grows, the demands are going to be for very high capacities.

This large growth is why the terrestrial costs are going down so rapidly. And when we do use satellites domestically, it will take whole satellites to just provide a small bit of service.

If you look at picture phone, it provides a whole million-cycle, 1 megacycle or megahertz bandwidth, that by the end of this decade is going to be available on a dial basis over a major portion of the country.

It can be used not just for picture phone, but a wide range of uses, some of those that you talked about, a wide range of kinds of terminal devices for visual displays and inputs and outputs, and really the hope for this whole broad spectrum of the kinds of uses that you, Mr. Pettis, were talking about, lies in a nationwide integrated switched system, common user, that can be available on demand for a wide range of uses. I think this is very exciting and the uses are just going to expand by leaps and bounds. Our objective is to make this switched network, whether it be the picture phone or 50-kilobit, as we call it, switched network, which we are just starting now, or the regular telephone network as flexible and as usable by as many people for as many different purposes, with as many different kinds of end devices as possible.

That is the real challenge over the next 10 years, and the thing that is really going to bring about all of these things that many people talk about as being very desirable. And get it out to all the places, way out in the boondocks as well as in close. Satellites are going to be a part of that, but an integrated part, and not a separate system in themselves.

Mr. KARTH. You'd better be careful with this picture phone business. I often answer the telephone dressed in somewhat less than an appropriate manner.

Mr. HOUGH. Well, we have a little button on there that takes care of that. You push that and they can't see you.

Mr. KARTH. The House is now apparently calling Mr. Pettis and the rest of us to the floor. Just one last question, Mr. Hough.

I think ABC and the Ford Foundation have requested authority to install a dedicated satellite system, for television only. What would A.T. & T.'s position be on that?

Mr. HOUGH. Our position is that if they feel that one would be more economical than the way they are served at present, that they ought to prepare an application and file it and let all of us look at it on its

merits. There are many public interest considerations that the Federal Communications Commission will want to make, and we will want to have a good look at it, too.

Mr. KARTH. Has ABC filed?

Mr. HOUGH. They did file a number of years ago, and that was folded into this domestic communication satellite investigation of the FCC. There is no pending application at the moment. We are sort of awaiting a policy statement.

Mr. KARTH. Yes. Then also for the record, I wonder if you could supply us with your thoughts on the advantages and the disadvantages of open competition in domestic communications?

Mr. HOUGH. Yes, sir.

(Information requested for the record follows:)

With respect to your request for my views on the question of competition in domestic communications, let me assure you that the Bell System does not seek arbitrary immunity from competition.

On the contrary, where it can be demonstrated that competition would result in actual benefits to the public—not merely the theoretical benefits of competition for competition's sake—we feel it should be encouraged. And, as I stated before your Committee, we feel that the existing common carriers should be allowed to compete under the same ground rules which would apply to any new or prospective entrant in the communications field.

Recently a number of proposals have been advanced by organizations seeking to provide—some in competition with one another—communications services along selected routes already served by common carriers.

We believe that each of these proposals ought to be examined on its specific merits. The paramount consideration in any such determinations must be the long-run interests of the general users of communications services—the public at large—which includes due consideration to any jeopardy to the benefits to the communications using public known to flow from the time-tested common carrier principle.

The same principles should apply in the case of satellites. We believe there is a potential for their use in domestic communications and that any private organization or group interested in establishing a domestic system for its own use should be permitted to seek authorization to do so. We would hope, however, that such authorization would be granted or withheld, as the case may be, not on the basis of the medium's glamour, but rather on the basis of a realistic appraisal of the benefits and costs to the public of the projected service. This appraisal should include, among other things, determination of the most appropriate usage of the available frequency spectrum and orbital space. For, as I stated before your Committee, satellites can provide no services that cannot presently be provided by other modes of transmission.

We also feel strongly that the common carriers—including AT&T—should have the opportunity to use and own communications satellites whenever it is to the public advantage that they do so.

In conclusion, we believe that competition which serves the broad public interest is constructive and should be welcomed. On the other hand, competition which is artificially introduced or which may serve some special interest at the expense of the broader interests of the communications using public should be carefully avoided.

Mr. KARTH. Are there further questions?

Mr. PETTIS. No.

Mr. KARTH. Well, thank you very much, Mr. Hough. You have been most helpful to the committee.

Mr. HOUGH. You are welcome.

Mr. KARTH. We may even want, in the foreseeable future, to call you back.

Mr. HOUGH. I will be very happy to do whatever I can.

Mr. KARTH. Thank you very much. The meeting is adjourned.

(Whereupon, at 12:50 p.m., the subcommittee was adjourned.)

# ASSESSMENT OF SPACE COMMUNICATIONS TECHNOLOGY

FRIDAY, DECEMBER 19, 1969

HOUSE OF REPRESENTATIVES,
COMMITTEE ON SCIENCE AND ASTRONAUTICS,
SUBCOMMITTEE ON SPACE SCIENCE AND APPLICATIONS,
*Washington, D.C.*

The subcommittee met, pursuant to notice, at 10 a.m. in room 2325, Rayburn House Office Building, Hon. Joseph E. Karth (chairman of the subcommittee), presiding.

Mr. KARTH. The committee will be in order.

Today will be our last day of hearings on the subcommittee's assessment of communications satellite technology and the extent to which it has been or could be applied to the benefit of mankind; of particular interest is its application to domestic uses.

The other day, Dr. Joseph Charyk was here, President of the Communications Satellite Corporation, and I'm afraid we short-changed him on time. The members did not have an opportunity to ask as many questions as they would like to have asked, and Dr. Charyk didn't have an opportunity to discuss in detail the statement that he presented to the committee.

The fact of the matter is, if I remember correctly, we asked that the first 18 pages of his statement be printed in the record and he was not given the opportunity to read that material at that time.

So I think in all fairness to the witness, the committee saw fit to call him back again today and we are very pleased and happy, sir, that you could accommodate the committee.

## STATEMENT OF DR. JOSEPH V. CHARYK, PRESIDENT, COMMUNICATIONS SATELLITE CORPORATION

Dr. CHARYK. I am very happy to be here, Mr. Chairman.

Mr. KARTH. We recognize you at this time for any further statement you might choose to make on the subject before the committee.

Dr. CHARYK. I would only like to reemphasize that we believe satellites can play an important role in domestic communications, not only for the lower 48, but we feel that satellites can do a unique job for communications in Alaska.

We feel that the best solution to the important communications problems in Alaska will depend on the use of satellites, and that the most economical solution will be obtained by accommodating Alaskan needs through a spot beam in a domestic communications satellite system, which also serves the other 48 States.

To this end, we have for some time been working with the proper interests in Alaska to devise or to help devise a master plan for communications in Alaska. It might be of interest to the committee to look at a couple of charts which show the present situation in Alaska—rather inadequate communications, saturated communications in many places, and an expensive system to operate.

The microwave interconnections are shown in blue, and the tropo links are shown in red.

Mr. KARTH. Could you describe what you mean by a tropo link?

Dr. CHARYK. Perhaps Mr. Miller could go into some detail on this system.

Mr. KARTH. Mr. Miller.

Mr. MILLER. The network shown in red is what is called a tropospheric scattered system. The word "troposopheric" refers to one of the layers in the atmosphere. The transmitted radio signals are bounced off the troposophere and they come back down to the earth at a distance of anywhere from just a few miles to a few hundred miles away.

This system is entirely military-owned and operated in Alaska, and it constitutes at the present time the backbone of the Alaska communications system. For many technical reasons it has its limitations in capacity and quality of service.

Mr. KARTH. That, I think, for the record we would like to get into in some depth, if you could, please.

Mr. MILLER. Yes, sir. For example, one of the severely limited portions—There are two or three of them in the whole network that are quite limited—one of them is the link from Fort Yukon up to the North Slope—the Barter Island area. This link, which is quite long, did not meet its design requirements. If my memory is correct its capacity is currently limited to about 36 telephone voice channels. That is all that can be passed over it without a substantial duplication of the existing facilities. The equipment there is operating at about the maximum which the state of the art will support.

There are similar limitations out in the Aleutian chain. The two links here, from Nikolski to Shemya and to Adak, distances of about 400 miles, are taxing the capability of this method of communications. Lisburne to Kotzebue is another link that is severely limited. There are other links in the interior area that definitely have a capacity limitation.

There are also problems with some of these links down through southern Alaska. I think this particular system is fully loaded at the moment, and increased capacity probably cannot be obtained without a huge expenditure on the order of, well, a rough estimate, $50 to $75 million, in overbuild costs to increase its capacity to meet the current needs.

Mr. KARTH. What is the ratio of the tropo system compared to the microwave system, that is now in use in Alaska? I see that the red, which is the tropo system, is what, 10 or 12 times as long?

Mr. MILLER. I don't have the firm figures on that, but the only microwave systems of any consequence that are in use are this down to the Canadian border, and then a system interconnecting Anchorage, Fairbanks and Homer, which is down on the Kenai Peninsula.

The distance to Canada is about 300 miles, something on that order.

Perhaps 400 miles; about 200 miles, a little more, to Homer. The other mileage—the Tropo system—is several thousand.

Dr. CHARYK. We feel that the ultimate answer lies in a combination of terrestrial and satellite means. The next chart will show our concept of locating a pattern of satellite earth stations, throughout Alaska, at the major centers where communication needs exist and interconnecting them, through appropriate facilities on the ground, to produce a complete system of communications facilities for Alaska.

Mr. KARTH. To whom has this proposal been made, Dr. Charyk?

Dr. CHARYK. This proposal was recently presented to a meeting in Alaska of the special study group set up by the Governor to come up with a master plan of communications for Alaska. The master plan is being developed by representatives of COMSAT, of RCA, representatives from the State of Alaska and the military.

It is hoped to have a final agreed upon plan by the end of January. This could then become the basis for moving ahead. Of course, the ultimate economics of such a system depend upon the satellite that is utilized. We feel that the real answer lies in a satellite with a spot beam for Alaska, but with another beam covering the lower 48, and providing communications facilities throughout the lower 48.

Mr. KARTH. There was some testimony yesterday, Doctor, to the effect that that would not provide an optimum system, that there would be some rather serious shortcomings associated with such a system as that, where you would try to cover the 48 and also beam into Alaska with the same satellite.

Could you give the committee your ideas on that particular aspect of your proposal?

Dr. CHARYK. Actually, the satellite which we envision as meeting these needs would be a satellite that would be located in synchronous orbit over the equator and at a longitude roughly that of Los Angeles. One beam of such a satellite would illuminate all of Alaska, all the way out to Shemya in the Aleutian Chain.

Another beam of such a satellite would illuminate the 48 States on the mainland. In order to receive up to 24 television channels, we would require on the ground, for reception purposes, a 32-foot diameter antenna.

We believe that the cost of such a receiving installation should not exceed $200,000. To do a comprehensive job throughout the United States would require somewhere between 250 and 300 such stations.

In Alaska, I believe, the number of stations required in order to carry out the plan depicted on the chart is of the order of 14. We think that a satellite of this configuration, which could be in orbit in about 2 years, can not only meet the basic Alaskan needs, but can also do a rather impressive job for the lower 48.

As I indicated the other day, we have had a number of discussions with the commercial television networks, with the Corporation for Public Broadcasting, with newspaper interests, with community antenna television representatives, and I think it is fair to say that without exception, they have felt that the kind of system that we have described would not only do a meaningful job for them, but that the economics of such a system, even in its earliest phases, would appear to be quite attractive, when compared with what they are now paying for services—services that do not begin to be as comprehensive

as those which would be provided by the system that I have described.

Mr. KARTH. That applies also to the lower 48?

Dr. CHARYK. Yes.

Mr. KARTH. Well, yesterday there was testimony to the effect that there are no communications services—let me just read this one sentence—

**There are no communications services which could be offered by satellites which cannot now be offered over terrestrial facilities.**

That is a pretty all-inclusive and positive statement. Now, what advantages or what benefits would be made available by such a synchronous satellite, serving the 48 as well as the State of Alaska?

Dr. CHARYK. The basic attribute of a satellite system, of course, is its ability to interconnect an unlimited number of points. A cable facility or a microwave facility really interconnects only two points, whereas a satellite, with its antenna configured, let us say, to illuminate all 48 States, can provide the complete range of services to any locality within the United States, no matter how remote, provided that an appropriate receiving station is built in that location.

It would be impractical to interconnect all the communities in the United States, including the remote communities, with a capability amounting to 24 television channels. It also appears that the basic services that are required by the users that I have mentioned earlier can be met on a more economical basis through satellite means at least when compared with the charges that they are now paying for services.

Mr. KARTH. Do you have any idea, Doctor, what the difference in charges might be with a system such as you propose, as compared to the existing system of communications? I think the record will show that yesterday testimony was given to the effect that there would probably be very little, if any, difference in cost, and if there was a difference, it might be that the satellite system would cost more.

Dr. CHARYK. I believe that the three commercial television networks, and they could provide these numbers better than I, are paying something of the order of $65 million a year for commercial television distribution throughout the United States. This is for a rather limited number of television channels.

I indicated the other day that it is our estimate that a satellite system, with a capability of 24 television channels nationwide, and with a complete spare in orbit, would have an annual revenue requirement of the order of $30 to $40 million. This suggests a substantial difference.

Now, of course, to that $30 or $40 million would have to be added, as far as the commercial television networks are concerned, the costs of local connections, which would be terrestrial connections. The impression that we have received from the television networks is that they see a significant economic advantage in the use of satellites, and I think that this is the reason for their rather considerable interest in a satellite system to meet their domestic needs.

If there were no economic advantage, I doubt that the commercial television networks would be as interested as they appear to be in using satellites for domestic television distribution.

The same thing applies to the various newspaper interests who are paying rather substantial bills, and who feel that through the use of a multipurpose satellite system, not only can the costs of their services

be reduced but that the services in addition can be significantly expanded.

There is an interesting potential that is foreseen by the CATV interests. It becomes possible through a satellite system to interconnect all of the individual local CATV systems throughout the Nation. This really produces a rather dramatic new potential.

I think that further stimulus is given to the commercial television people by a series of rate increases for distributing their television programs nationwide. So we are confident and I think the users are confident that satellites can provide not only important economic advantages, but a much wider range of services than is economically possible today using terrestrial means alone.

Mr. KARTH. Well, Doctor, yesterday a very able witness, Mr. Hough, of the American Telephone & Telegraph Co., gave the committee some interesting statistics, and those statistics, of course, are in line with improved terrestrial capabilities. Let me just read to you what those figures are, as they were given to us yesterday.

Mr. Hough said, and I quote from page 3 of his testimony:

> The upcoming INTELSAT IV will have a capacity of about 9,600 voice grade circuits. However, there is now in service the L–4 coaxial cable, which has a capacity of 32,400 voice grade circuits. And then in the same time frame as INTELSAT IV there will be installed the L–5 coaxial cable, which will have a capacity of 90,000 voice grade circuits.
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> Even on transcontinental routes it now appears that the cost per circuit mile of the L–4 and the L–5 cables would be substantially less than that of INTELSAT IV satellites. As circuit requirements increase, L–4 routes can readily be converted to L–5 at even lower costs.

Would you care to comment on that?

Dr. CHARYK. Yes. With all due respect to Mr. Hough, I think that sort of gives a rather misleading comparison between terrestrial facilities and satellite facilities. It is true, of course, that the capacity of an INTELSAT IV is of the order of 9,000 circuits.

On the other hand, the antenna beam of an INTELSAT IV illuminates 40 percent of the earth's surface, which means that you have a capability for 9,000 circuits between any combination of points on that portion of the world that the satellite can see.

This is compared with a terrestrial link which simply connects two points. Now, if I want to optimize the capability of the satellite and interconnect only two points, instead of illuminating 40 percent of the earth's surface, I would direct all of the energy into two small beams, which simply cover the two points that I want to interconnect.

Then the effective capacity of the satellite would be increased enormously. I think it is rather misleading to think of a satellite as simply providing interconnection between two points, in the same way that a cable or a microwave link interconnects only two points.

The real merit of a satellite lies in its ability to interconnect an unlimited number of potential customers, which can be distributed as indicated over an area as broad as 40 percent of the earth's surface.

So there is a unique advantage to satellites in being able to provide this multipoint interconnection—a capability which cannot begin to be approached by terrestrial or cable facilities. For example, to interconnect by cables all the points in the Atlantic basin that are now served by satellite, and which range all the way from a station in Santiago, Chile, to a station in Iran, would be a prohibitive economic undertaking.

The advantage of cable links is in interconnecting two points involving very dense traffic. The satellite has the unique advantage of being able to interconnect a very large number of points, and I am surprised therefore that in making a comparison, Mr. Hough indicated that communications satellites comprise a facility for transmission identical in function to microwave radio systems and coaxial cables. I think they are completely different.

He goes on to say that a communications satellite may be regarded as an intermediate amplifier between two earth stations. That also completely misses the main advantage of a satellite system. A satellite really is a completely new means of communications, and cannot simply be compared with another cable.

As a matter of fact, I am reminded of the story of the rather elderly general who in 1945 was asked his opinion of the device that had just destroyed Hiroshima, and his answer was that warfare hadn't changed at all, it was just another kind of bomb.

I think the same comment could apply to a representative that communications satellites are the same as cable and microwave facilities.

Mr. KARTH. At one other point, Dr. Charyk, the witness we are referring to, Mr. Hough, made another point on page 4 of his statement—and the reason I am asking these questions is because this committee does not want to be in a position of overselling a communications system that really ought not to be oversold, or ought not to be sold at all—this committee has been of the opinion that communications satellites and the application of that technology could substantially increase the communications opportunities for the American people, and all we are interested in is getting the facts.

If this committee has been in error, I want the record to show that; by the same token, of course, if we have not been in error we would like to have the record show that, too. That is the reason I am asking these questions, not to provoke an argument between two expert witnesses, or for that matter between representatives of two different systems of communications; rather, I wish to elicit the facts, and hopefully so that we can draft a report that is factual, and will make recommendations that the Congress of the United States, the administration, that is, appropriate committees of the Congress and agencies of the executive branch might find meaningful.

I will read one other sentence from Mr. Hough's statement and then ask for your comment. On page 4, Mr. Hough said: "Communications satellites are vulnerable to different types of failures than are terrestrial facilities, and have different transmission problems, the problem of delay being an important one."

This matter of delay has concerned this committee. I wonder if you would care to tell the committee for the record what this problem is, and what you see as a possible correction for it, if there is one.

Dr. CHARYK. Delay refers to the fact that a synchronous satellite, out at an altitude of 22,300 miles, produces a situation whereby in order for a signal to pass from one subscriber through the satellite to the party on the other end, and for a reply to then come back through that satellite, a passage of time of the order of six-tenths of a second is required.

This is of no importance for any type of communications other than voice communications. And here the question was raised as to whether

a telephone subscriber would be bothered by this delay. In other words, if a question is asked, an answer cannot be received in less than six-tenths of a second. Would the average telephone user find this troublesome?

It is my opinion that the delay, per se, is not of key importance. What is of key importance is having present in the system adequate and properly adjusted echo suppressors. Since we are transitioning from a four-wire system to a two-wire system in the home telephone, it is important to design the system so that an echo is not received in addition to the direct signal.

Modern echo suppressors have a very excellent performance, and when they are properly adjusted, for all practical purposes the echo problem can be eliminated. If the echo problem is eliminated, then I think that the experience in transcontinental service over the past few years is that the time delay is not objectionable.

The majority of customers, at least, provided proper echo suppressors are installed, do not have difficulty with the time delay problem.

Mr. KARTH. The additional cost associated with that, is that all part of your original cost estimate that you gave the committee here just moments ago? You talked about a $60 million cost for a domestic satellite system, I think.

Dr. CHARYK. For television distribution, the time delay is of no consequence. In other words, it simply means that you are seeing the television image three-tenths of a second after the event actually happened, which is of no consequence at all. For television purposes, the echo suppressor is not a factor. It becomes a factor only in telephonic communications.

Mr. KARTH. I see.

Dr. CHARYK. And in the case of the system that we are talking about for domestic purposes, it would appear that the initial use of such a system would be for television, record and data traffic. I think A.T. & T. has indicated that it is not particularly interested, at least in the early time frame, in using satellites for telephonic communications in the United States.

I think it is fair to say, however, that if satellites were to be used domestically for telephoning, it would require the replacement of a very large number of echo suppressors which are installed in the U.S. domestic system today, and which by and large are of a type that would not operate satisfactorily.

In other words, new echo suppressors would have to be installed throughout the United States for a full-fledged application of satellites for telephonic purposes in the United States. These costs are not included in any numbers that I have indicated, but would be costs, of course, that the telephone company would have to bear if it were going to make extensive use of satellites for domestic applications.

Mr. KARTH. In your opinion, Doctor, what has caused the delay of almost 4 years in arriving at a decision regarding the use of communication satellites for domestic purposes?

Dr. CHARYK. I think that several factors are responsible. First of all, there are, I think, legitimate questions about the state of technical development and the economics of such a system. There is also, of course, an interest on the part of a great many different entities in having a role in domestic satellite applications.

So in a strange way, I think the very success of satellites for international application has complicated the problem of authorization on the domestic scene, because with the international success, it would appear that satellites are a good thing, and so everyone wants to get into the act domestically.

As a result, the FCC has been faced with a large number of interested parties, all contending that they should have some role on the domestic scene, and with the 1962 act, not being completely explicit on who should have the authority to develop satellites for domestic applications, a rather confused picture has been created, and it has not been possible to evolve within the present structure, a statement of national policy.

An attempt has been made to do this, of course, through the various studies that have been set up, and also the study which is now underway within the executive branch of the Government. We are, of course, hopeful that as a result of this study, a basic policy will be enunciated which will provide a basis for the FCC to proceed to authorize someone to establish at least an initial domestic satellite system, because we are convinced that such a system can provide meaningful, economical services of various types to people throughout this country.

Mr. KARTH. Doctor, what is your current view of the so-called rate base approach to charging customers for communications service in view of the new satellite technology?

Dr. CHARYK. I think that in due course some serious consideration needs to be given to whether this alone is a proper criterion for determining the earnings of a company. Rate base simply means that the amount that a communications company is allowed to earn is dependent upon its investment in facilities.

So that the larger the investment in facilities, the larger the earnings, assuming the percent return is fixed.

Mr. KARTH. Has this had the tendency to retard the use of satellites for communications purposes, in your judgment?

Dr. CHARYK. Well, I think in the case of satellites, you have a rather unique situation. The only customers of COMSAT under present FCC rules are the communications companies. If the communications companies lease a satellite circuit from COMSAT, it is simply an item of expense, as far as they are concerned.

If they are able to provide the service, using a circuit in a facility that they own, then they are allowed to earn on that investment. So that there is in a sense, under the present structure, you might say almost an economic disincentive to use a satellite circuit regardless of the price of that satellite circuit, if it is possible to provide the service through a facility which that communications company owns.

This is a rather strange arrangement, which I think has had some effect on the pattern of communication facility use over the last few years, as between satellite use on the one hand and cable use on the other. It has also encouraged the filing of applications for new cable facilities.

If I may elaborate further on the rate base item. We, of course, are aware that the technology of satellites is moving ahead at a rapid rate. If rate base is the only criterion for determining rate of return, and if COMSAT is able to build satellites of ever-increasing capacity as well as satellites that will continue to operate for many years, we would be faced with a diminishing rate base and diminishing earnings.

In other words, if we were very clever and if we were to build good satellites and they were to last for a long time, in a sense this would be working against our best economic interest—a rather strange system.

There could possibly arise even a lack of encouragement to produce the most efficient, highest-capacity facilities, if in the long haul rate base would remain the only criterion for determining return.

It is not a problem to COMSAT at the moment. But looking sufficiently far into the future it could well become a problem.

Mr. KARTH. Mr. Symington.

Mr. SYMINGTON. Mr. Chairman, I wonder if Dr. Charyk would restate that problem again. I fell off the train there. The problem of increased efficiency creates diminished returns?

Dr. CHARYK. On the basis of the present system, we are allowed to earn in relationship to our investment in facilities, that is, our earnings are directly related to our total investment in facilities. The more facilities we have, the more money the corporation can earn.

Mr. KARTH. In other words, the rate base makes absolutely no sense at all, if you are going to a communications satellite system or some other system that is more efficient.

Dr. CHARYK. In other words, if I were able to build satellites of tremendous capacity, to handle all known needs, and if I were very clever and these satellites were to continue to operate for years and years, I would over a period of time have these satellites fully depreciated. Over this period my active investment in facilities would be continuously going down, since the existing satellites could handle all the needs and no additional facilities would be required.

Accordingly, my earnings would be going down all the time. On the other hand, if I am not very clever, and I can't build satellites with huge capacity and if they are not very good and if they fail once a year and I have to keep replacing them, my earnings could skyrocket. This seems like a rather strange system.

Mr. KARTH. But using the first for instance, where you are clever, and we think that you are, and as a result of that you would retire your investment over a period of time, and consequently the application of the rate base system would cause, in effect, a corresponding decrease in the cost to the consumer; wouldn't it?

Dr. CHARYK. It would certainly do that.

Mr. KARTH. So the longer satellites would last, if the rate base system were applied to them, as well as its being applied to the present system, the more economical satellite communications systems would become; is that right?

Dr. CHARYK. Yes. But I think that a logical system would want to have some correlation between return to the company and benefits that can be provided to the consumer. In other words, ideally you would like to see a system where the best job that we can do in providing a wide range of services to the ultimate user, at even lower cost would be reflected in better earnings for the corporation.

The present system would appear to have the thing backward.

Mr. KARTH. All right. Excuse me, Mr. Symington.

Mr. SYMINGTON. Thank you, Mr. Chairman. You mentioned receiving stations at a cost of $200,000. What kind of an area would such a receiving station serve?

Dr. CHARYK. I would think that such a receiving station would serve a major metropolitan area.

Mr. KARTH. Like New York City, for example?

Dr. CHARYK. Like New York City or like Washington. For example, in the type of system that we envision, there would probably be such a station here in the Washington area, and it would be connected by facilities on the ground to the three major television network stations here in Washington, as well as to the educational television station in Washington.

Mr. SYMINGTON. What about the remote areas in Alaska, for example?

Dr. CHARYK. Well, the stations would be located as I have indicated on the chart, and terrestrial facilities would be used to interconnect these stations to the major communities in the immediate vicinity of the station.

Mr. KARTH. Will the gentleman yield?

Mr. SYMINGTON. Yes.

Mr. KARTH. Just to get for the record the cost of that system, insofar as it relates to these 32-foot dishes, that would be approximately $2,400,000 for that entire Alaska system; is that correct?

Dr. CHARYK. As far as the receiving stations are concerned, that would be of the right order if the stations were to be used for television receiving only in the lower 48. However, in Alaska we desire to provide a wide range of two-way telecommunication services for both inter- and intra-Alaska needs. Such services are in addition to a simple receive TV only situation. The stations contemplated for Alaska as a result are substantially more elaborate than the 32-foot TV receive only stations envisioned in the lower 48.

The Alaskan stations require several expensive equipment additions, such as cryogenically cooled low noise receivers, voice multiplexing terminal equipments and transmitting terminals. These additional equipment requirements increase the unit station costs by a factor of three or four. In addition to increased equipment costs, the Alaskan installations must take into consideration the substantially increased transportation and construction costs which exist in the area. Such costs run from 1.5 to 4 times the equivalent costs in the lower 48, dependent upon the specific location which is involved. For these reasons the installed cost of a 32-foot station in Alaska will vary considerably with location and with the precise capability desired. The cost could exceed $1 million in remote areas of the State.

Mr. KARTH. I see.

Mr. SYMINGTON. Does that include the connections?

Dr. CHARYK. It would not include the connections, and I don't have a figure for the cost of the particular terrestrial network shown there.

Mr. SYMINGTON. We had testimony yesterday that if a single satellite attempted to serve both Alaska and the lower 48, a compromise in the orbit would be required. Is that a real problem?

Dr. CHARYK. No, it is not a problem at all. The satellite would be located at a longitude roughly that of Los Angeles, and one beam would be pointed at the lower 48, and one beam at Alaska, and the kind of stations that I have described here, namely these 32-foot diameter stations, would have the capability for receiving up to 24 television channels.

Mr. SYMINGTON. I am trying, Mr. Chairman, to sum up what I think I might have learned, as to the points of view expressed by A.T. & T., RCA and COMSAT. It seems that when asked about domestic service, and the use of satellites for that purpose, for the lower 48, RCA seemed to feel that they are not involved in domestic service, they are an international carrier.

However, they seem to consider Alaska as constituting an international type of service. And they would like to have a satellite for that possibly.

Dr. CHARYK. The reason for that is that RCA is an international communications carrier. It is not authorized to operate in the lower 48. By virtue of being the purchaser of the Alaska Communications System, it will presumably receive in due course appropriate authority to operate within Alaska.

But they do not have authority to operate in the lower 48. So clearly, therefore, they would not have a direct interest in communications satellites in the lower 48.

Mr. SYMINGTON. If it is an important question, who decides the question of whether Alaskan service is domestic or international? Is that an FCC decision? And if so, has it been made?

Dr. CHARYK. Well, the FCC and the Public Service Commission in Alaska will have to authorize RCA to operate in Alaska. Within the lower 48, the American Telephone and Telegraph Co. is, of course, the major carrier. Western Union is another carrier operating in the lower 48, but of course is confined to nonvoice service.

Mr. SYMINGTON. It seems that A.T. & T. does not conceive satellite service necessary for the lower 48, and argues that terrestrial communication is equally efficient, if not more so, and cheaper. However, when they began to think of Alaska, they also seem to feel that there would be some utility to supplementing terrestrial connections with a satellite service.

Dr. CHARYK. Of course A.T. & T. does not operate in Alaska.

Mr. SYMINGTON. Right. But they were hypothesizing.

Mr. KARTH. I think the important thing is whether or not you agree with the first part of that statement.

Dr. CHARYK. I think the best answer as to whether satellites have a potential economic advantage domestically might be obtained by asking the people who pay the bills, and here I can only say that in our conversations at some length with the major television networks who are major users of the U.S. domestic facilities—the wire services, newspapers, community antenna television people, data people, the Air Transport Association—almost without exception, these users feel that satellites have important economic benefits, and they are interested in the use of satellites to meet their domestic needs.

Mr. SYMINGTON. Well, that, Mr. Chairman, was to be my next question; that is, to discover the attitudes of the users, and perhaps we could use some documentation of that, if not some testimony, because I think we are getting closer now to what it is we are really striving for, which is the cheapest possible and most efficient communication of voice, television, whatever for the benefit of our citizens.

That is all I have at the moment, Mr. Chairman.

Mr. KARTH. Mr. Koch.

Mr. KOCH. No questions.

Mr. KARTH. I think, Dr. Charyk, the last point raised by my colleague from Missouri is whether or not we could get some evidence of this interest on the part of the major networks, and those other groups of users that you referred to. Would it be possible for you to supply that information for the record, or would it be necessary for counsel to solicit that information from those people directly?

Dr. CHARYK. I would feel that a direct approach to the commercial television networks by the committee might be a better route. On the other hand, there are public statements made by Dr. Stanton of CBS not too long ago indicating that in his opinion the time had come when we should move ahead to establish a satellite system for commerical television distribution in the United States, and that it was his feeling and I believe it is supported by the presidents of the other networks that there would be significant economic advantages through the use of satellites.

Actually, as has been pointed out in earlier testimony, the American Broadcasting Co. made a formal application to establish a satellite system for the commercial television network, some years ago, so that they were convinced even at that time that satellites had some rather unique advantages for commercial television as well as significant economic advantages.

Mr. KARTH. Without objection, and with the approval of the gentleman from Missouri, I think in addition to what Dr. Charyk has said, I would instruct counsel to solicit such information to answer his inquiry from those user groups that have already been alluded to.

Dr. CHARYK. It might also be useful to include, for example, the American Newspaper Publishers Association, another important category of user.

Mr. KARTH. Yes.

Dr. CHARYK. The wire services and so on.

Mr. KARTH. Those I think you had previously mentioned in your statement.

Dr. CHARYK. Yes.

HOUSE OF REPRESENTATIVES,
COMMITTEE ON SCIENCE AND ASTRONAUTICS,
*Washington, D.C., January 9, 1970.*

Mr. DANIEL DE LUCE,
*Assistant General Manager, Associated Press.*
*New York, N.Y.*

DEAR MR. DE LUCE: Last month the Subcommittee on Space Science and Applications held hearings to assess the current state of communications satellite technology, the applicability of satellites to a domestic communications system, and the various institutional and organizational obstacles to their effective utilization.

During the course of the hearings, Dr. Joseph Charyk, President of the Communications Satellite Corporation, testified to the effect that many business and industrial leaders had expressed enthusiasm over the possibility of communication services being made available by a domestic satellite system.

Congressman Joseph E. Karth, Chairman of the Subcommittee, has asked me to get expressions of opinion from potential users of such a system, particularly on the question of its economic viability. Accordingly, your views are invited on the desirability of establishing a domestic communications satellite system, together with any comments or recommendations you may wish to make regarding the current state of affairs.

Let me thank you in advance for your assistance.

Sincerely,

FRANK R. HAMMILL, Jr., *Counsel.*

(Identical letters were forwarded to the following respondents:)

THE ASSOCIATED PRESS,
*New York, N.Y., January 21, 1970.*

Mr. FRANK R. HAMMILL, Jr.,
*Counsel, Committee on Science and Astronautics, House of Representatives, Rayburn House Office Building, Washington, D.C.*

DEAR MR. HAMMILL: Thank you for your letter of January 9.

The Associated Press has informed the Communications Satellite Corporation that it welcomes its proposal to establish a domestic satellite system in which the press could lease communications channels.

I enclose a copy of a letter which expresses The Associated Press' position.

We hope that the House Subcommittee on Space Science and Applications will exert a favorable influence on the early development of a domestic satellite system along the lines described by Dr. Joseph Charyk in his recent testimony.

If we can help further, please let us know.

Sincerely,

DANIEL DE LUCE.

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THE ASSOCIATED PRESS,
*New York, N.Y., November 7, 1969.*

Gen. GEORGE P. SAMPSON,
*Vice President, Operations, Communications Satellite Corp., Washington, D.C.*

DEAR GENERAL SAMPSON: On behalf of The Associated Press, I wish to express our appreciation for the COMSAT briefing on the proposed domestic satellite system which was given newspaper industry and press association representatives at your headquarters November 5.

Especially noteworthy, we feel, are the principles of the "Non-Exclusive Cooperative" which COMSAT favors for the domestic system.

As envisioned by COMSAT, this domestic system would be non exclusive in that the user category would be open ended and new users could be added at any time. This domestic system would be cooperative in that tariff charges would carry the cost of the system, additional revenues could reduce the users' costs, and flexibility would prevail as regards ownership of receive-only stations.

These principles for the domestic satellite system of the future would be of significant and constructive benefit to the dissemination of news in our nation.

The Associated Press desires to use this future domestic satellite system, as planned by COMSAT. We will want to cooperate closely with your staff, so that COMSAT will know our communications requirements and we can implement our planning without uncertainty.

The Associated Press is the largest press customer of AT&T. Together with United Press International, we sought unsuccessfully to have the AT&T Telpak tariff liberalized to permit the two major press associations to share a Telpak lease.

Until Telpak A was cancelled in 1967, our Telpak A lease extended 10,000 miles across the United States and was billed at approximately $2,000,000 yearly by AT&T.

At present, we lease Telpak C in the northeast states. This is, of course, equivalent to 60 voice channels or 240-khz bandwidth. Under the reasonable economics which the domestic satellite system could create, The Associated Press would have a requirement for 240-khz bandwidth New York-Los Angeles.

This 240-khz bandwidth requirement refers to The Associated Press alone. We stand ready to cooperate with AP newspaper and broadcast members and with United Press International in combining industry bandwidth requirements and terminal facilities for maximum service and economy. Thus 240-khz could be just a starter for our combined planning.

Again, our warmest appreciation for COMSAT's hopeful progress toward a domestic satellite system that could be so useful to all news media.

With best regards.

Sincerely,

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AMERICAN NEWSPAPER PUBLISHERS ASSOCIATION,
*New York, N.Y., January 15, 1970.*

Hon. JOSEPH E. KARTH,
*Chairman, Subcommittee on Space Science and Applications,*
*House of Representatives, Washington, D.C.*

DEAR CONGRESSMAN KARTH: We were pleased to receive Mr. Hammill's letter of January 9 inviting our comment on the desirability of establishing a domestic communications satellite system.

We are indeed very much interested in assuring press participation in a domestic satellite communications system, and we are quite favorably impressed by the plans which have been outlined to us by COMSAT.

I am enclosing a copy of a letter we wrote on December 26 to the Chairman of the Federal Communications Commission, expressing our general views on this whole matter.

With high esteem.

Sincerely yours,

STANFORD SMITH, *General Manager.*

AMERICAN NEWSPAPER PUBLISHERS ASSOCIATION,
*New York, N.Y., December 26, 1969.*

Hon. DEAN BURCH,
*Chairman, Federal Communications Commission,*
*Washington, D.C.*

DEAR CHAIRMAN BURCH: We have noted with gratification published reports indicating that early authorization of a domestice satellite communications system is a subject which you regard as having high priority. We desire to record our strong endorsement of that position.

Representatives of the press, including ANPA and the news wire services, met with top officials of COMSAT on Wednesday, November 5, 1969 and we were briefed on its proposal for a domestic satellite system. One of the important features of the proposed system is that of providing for multi-purpose services. This is a matter of the keenest interest to the news wire services and newspaper publishers because of its promise for efficient and more economical news dissemination.

We understand that the proposed domestic satellite system would comprise earth stations on the east and west coasts in the vicinity of New York City and Los Angeles respectively and receiving only stations in the vicinity of the first 100 metropolitan centers of the United States, with a minimum transmission offering of a carrier-spectrum of 12 voice channels. In anticipation of the probable authorization of such a system, the ANPA Press Communications Committee, at its meeting on Monday, December 8, 1969, began a program to plan coordinated participation of the news wire services and newspaper publishers in a domestic satellite system.

Specifically, we are now endeavoring to ascertain the aggregate transmission requirements of the press between originating points on the east and west coasts and receiving points in the first 100 markets as of an operational date of 1972. We are undertaking to plan for the anticipated need to establish a cooperative entity having membership available to all press entities and which on a nondiscriminatory basis would perform the following functions (a) serve as the "single customer" of the participating news wire services in dealings with the earth station licensee and with the operators of the receiving stations; (b) lease or construct private systems for channels connecting the earth stations to the various traffic originating points and lease channels or construct private systems between the receiving stations and the newspaper, broadcasting stations and other news wire subscribers in the various cities served; (c) provide, operate, and maintain whatever equipment is needed to combined channels or signals in the form compatible for interface with the earth stations, and to provide, operate, and maintain channel deriving equipment and related facilities as necessary at the corresponding receiving stations, and (d) to serve as coordinator-manager and programmer of the news wire services' participation in the domestic satellite communications system.

We have a preliminary consensus from the interested major and supplemental news wire services favoring the establishment of such a single coordinating entity for the press, on the assumption that this arrangement is acceptable to the earth station licensee and the FCC. However, we would be willing to modify or alter these arrangements in any reasonable manner deemed more acceptable.

We are aware that the multi-purpose service contemplates arrangements for multi-party access to the receiving stations and we are prepared to coordinate arrangements for access by the press to such receiving stations.

We have presumed that the interest of the press in participating in the services of the domestic satellite communications system and our plans for the management of this participation are matters of interest to the Commission at the initial phase of any authorization. Please be assured of our cooperation and willingness to supply any further information desired for inclusion of news wire services in whatever authorizations or regulations are adopted for implementation of the domestic satellite system.

Yours very truly,

STANFORD SMITH, *General Manager.*

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NATIONAL BROADCASTING CO., INC.,
*New York, N.Y., January 21, 1970.*

Mr. FRANK R. HAMMILL, Jr.,
*Committee on Science and Astronautics, Rayburn House Office Building, Washington, D.C.*

DEAR MR. HAMMILL: Mr. Julian Goodman has discussed with me your letter of January 9, and since NBC's involvement in satellite communications falls within my general area of executive responsibility, he has asked me to respond directly to you.

I appreciate the opportunity to present NBC's views with regard to a domestic satellite system for broadcasting and to share them with the other members of the Subcommittee on Space Science and Applications. The potential use of satellites for television and radio program distribution has been the subject of continuous study at NBC for more than a decade. We have been deeply interested in the promise this technology offers with respect to improved signal quality, increased flexibility, and significant economies, compared with systems now generally in use. Despite major progress in technical sophistication, from Echo to INTELSAT III, satellite systems have so far been useful to us only for the transmission of programs on an international scale. They are not available for the distribution of programs domestically.

We have attempted to encourage the development of a domestic system by means of public presentations and by filing proposals, comments and recommendations with various Legislative and Executive bodies concerned with the applications of space communications technology. In April, 1966, we described a model system at a "COMSAT Seminar" held at the Mayflower Hotel in Washington. We concluded then that a satellite system responsive to the needs of commercial and noncommercial radio and television broadcasters could, within a relatively short time, replace much of our present interconnection facilities at substantially lower cost.

Since then, in several filings with the Federal Communications Commission (especially Docket 16495), in discussions with the Task Force on Communications Policy established by President Johnson, and most recently in a detailed reply to a request from Dr. Clay Whitehead of President Nixon's staff, we have restated our conviction that satellite communication systems should be authorized for the distribution of radio and television programs from networks to stations and between stations.

In addition to our own studies, we have been guided by the findings of various study groups outside the broadcasting industry. For example, a released report of the National Academy of Sciences Central Review Committee stated that the uses of satellites for network television transmission for both the private and public sectors of the industry seem "so easy technically, so reasonable economically, and so potentially desirable that we recommend consideration of their implementation by the proper authorities as a matter of high priority."

Our interest in developing alternatives to the AT&T terrestrial system has been intensified by the establishment of a new tariff that would increase our interconnection costs by over 60%. It appears to us that basic to his increase are AT&T plans for facilities changes designed exclusively to enhance its capacity to provide services other than network program distribution and that do not relate to our needs. In cooperation with the Corporation for Public Broadcasting, ABC, and CBS, we have undertaken a major study of all possible means to distribute programs including terrestrial systems, satellite systems, and combinations of such

systems. The cost of this study will be borne by the three commercial networks, and an initial report is expected in the second half of this year.

With respect to the economic viability of a domestic satellite system, all of our studies to date have indicated that a system designed primarily for network program distribution could replace substantial portions of the terrestrial system on a cost basis favorable to us. However, fundamental to our appraisal is the assumption that AT&T facilities will continue to be available at reasonable cost to supplement the satellite system, at least during the first five to ten years of satellite system use. Such facilities will be required for special News coverage and to interconnect stations which for reasons such as frequency interference cannot be served economically or efficiently by the satellite system.

The uncertainties relating to many of the basic requirements of a program distribution system by satellite continue to be an inhibiting factor in reaching a final course of action in this area. For example, the number, type and cost of earth stations, the availability and cost of launch facilities, the organizational structure of the group charged with the responsibility for coordinating these efforts all pose questions requiring involved examination. However, we believe the potential advantages of a domestic satellite system, including possible savings over current costs, are sufficiently great to warrant moving forward with our own studies and with pilot programs. A necessary first step is Federal Communications Commission authorization of the establishment of domestic satellite systems by both common carriers and specialized users, permitting marketplace competition to determine the most efficient and expeditious means of utilizing satellite system technology for the benefit of the public and private industry.

Sincerely,

GEORGE H. FUCHS.

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GENERAL ELECTRIC CO.,
*New York, N.Y., January 15, 1970.*

Mr. FRANK R. HAMMILL, Jr.,
*Counsel, Committee on Science and Astronautics, Rayburn House Office Building, Washington, D.C.*

DEAR MR. HAMMILL: In reply to your letter of January 9th to Mr. F. J. Borch inviting his views on the desirability of establishing a domestic communications satellite system, General Electric has expressed opinions on this question to the FCC, and we will be glad to accept your invitation to express further views to you.

We wish to be responsive to the specific points you have raised and will prepare and forward to you a brief statement.

Thank you for giving us the opportunity to state the views of General Electric.

Yours very truly,

HERSHNER CROSS.

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AMERICAN BROADCASTING CO., INC.,
*New York, N.Y., January 15, 1970.*

Mr. FRANK R. HAMMILL, Jr.,
*Counsel, Committee on Science and Astronautics, House of Representatives, Washington, D.C.*

DEAR MR. HAMMILL: Your letter of January 9, to Mr. Leonard H. Goldenson, has been referred to me for reply.

We appreciate your inviting ABC's views as to the desirability of establishing a domestic communications satellite system along with any comments we wish to make regarding the current situation.

I am sure that Congressman Karth, Chairman of the Subcommittee, is familiar with the fact that ABC was the first company to apply to the Federal Communications Commission (September 1965) for authority to establish a domestic television program distribution system using a synchronous satellite. It was our position then and now that private, non-governmental entities were not and are not precluded from this field by the Communications Satellite Act of 1962. As a result of our application the attention of the FCC, the Congress and other interested parties was focused on what we believe to be a vital public issue.

In our initial filing and subsequently, Mr. Goldenson made it clear that ABC was not seeking sole ownership of such a satellite system and that we would welcome the participation of other networks and the Corporation for Public

Broadcasting. Indeed, ABC in its plan offered to make one channel available without cost to National Education Television for transmission of its programs nationally to the educational television stations.

Of prime importance in our consideration is the opportunity which would be afforded to us by a domestic satellite system to improve our services to our affiliated stations and the public.

Such a system would provide the means of interconnecting the new states of Alaska and Hawaii, Puerto Rico and the Virgin Islands on a simultaneous basis so that these areas could be closely integrated into our national communications system. With the satellite operational 24 hours a day, the networks would be capable of transmission on a live and interconnected basis at all times. This would greatly expand all networks' capability of servicing affiliated stations and the public, particularly with respect to news, public affairs and special events , and would greatly augment the usefulness of such a system in national emergencies and for civil defense.

Finally, we concluded that all this could be achieved at substantial savings in our present program distribution cost. We think that these advantages are obvious both from a public as well as a private standpoint.

In order that the Committee may have full information as to ABC's activity and position on this question, I am enclosing Comments which were filed by ABC before the FCC in Docket 16495 (Establishment of Domestic Non-Common Carrier Communication-Satellite Facilities by Non-Governmental Entities) on August 1, 1966, December 16, 1966, April 3, 1967, September 18, 1967 and April 14, 1969. Enclosed also is a copy of a Statement which I made on behalf of the Company before the Communications Subcommittee of the U.S. Senate Committee on Commerce on August 23, 1966. In addition, I am enclosing for your Committee's background use copy of a letter from Mr. Goldenson, dated September 16, 1969 to the Honorable Clay T. Whitehead, Communications Advisor to the President, in response to a request for ABC's current ideas and comments on the benefits of satellite technology, particularly in the field of network broadcasting. The letter from Mr. Goldenson to Mr. Whitehead has not been made public by the Company and is furnished for the private use of the Space Science Subcommittee. I believe that these enclosures fully outline ABC's position and emphasize the urgency which we feel is attached to the implementation of a domestic satellite system under private auspices.

Anything which the Committee might do to further this approach by the Administration or by the Federal Communications Commission would be welcomed by ABC. If there is any additional information you require, please let us know.

Sincerely yours,

EVERETT H. ERLICK.

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UNITED PRESS INTERNATIONAL,
*New York, N.Y., January 14, 1970.*

Congressman JOSEPH E. KARTH,
*House of Representatives,*
*Washington, D.C.*

DEAR CONGRESSMAN KARTH: Counsel for the Committee on Science and Astronautics, Frank R. Hammill, Jr., has advised me of your desire to hear my views on the desirability of establishing a domestic communications satellite system.

United Press International is very much interested in a domestic communications satellite system. We serve 4,200 subscribers in the United States on a private leased wire network which we lease from AT&T for the distribution of our news and picture services. Unfortunately, the AT&T and Western Union are the only two carriers available to us on a nationwide basis and their tariffs for the various services we require are identical.

Communications costs represent a very substantial portion of our annual operating expense. Still there are broadcasters and newspapers in certain parts of the country whom we cannot serve because the line costs are too high.

The use of communications satellites has produced dramatic reductions in the costs of the facilities we use to gather and distribute our news reports between the U.S. and the rest of the world. As a result, we have improved and expanded our foreign services and our subscribers, both at home and abroad now receive much more information through our services than before, which means that the subsequent users of the services, the public, are better informed than ever before.

We believe a domestic satellite system would have a similar effect and that the

cost of communications facilities would go down, permitting us to extend and expand our services, which in turn, means a better informed American public.

It is our hope that there will be a domestic communications satellite system and that the press will be included among the authorized users of the system.

Sincerely,

MIMS THOMASON.

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COPLEY NEWSPAPERS,
*Washington, D.C., January 12, 1970.*

Mr. FRANK R. HAMMILL, Jr.,
*Committee on Science and Astronautics,*
*House of Representatives, Washington, D.C.*

DEAR MR. HAMMILL: I have your letter of January 9th inviting my views on the desirability of establishing a domestic communications satellite system. About two months ago I participated in a conference with officers of the Communications Satellite Corporation and press representatives. I am enclosing a press release concerning this conference which fairly expresses our strong support of the development of a domestic satellite system such as proposed by COMSAT. The total U.S. press communications requirements for a domestic satellite system could be as high as over 200 voice-grade channels and several video channels.

As I understand COMSAT's initial concept, there would be 100 receiving stations in the top 100 market areas. Such distribution is, of course, based principally on television requirements. There is, of course, no limit to the number of receiving stations which could be established. The estimated price per station seems low, something under $200,000, I believe. The number of receiving stations, of course, would be determined by demand requirements.

It would seem to me that the most economic advantageous use of the satellite system would be for longhaul, the cost of transmission, of course, being independent of distance. However, once a signal is received in an earth station it obviously must be distributed to be of any value. The cost of such distribution may present serious difficulties. For example, if you consider major wire services, they have customers in many areas far removed from the 100 largest market areas. Whether or not it would be economical and desirable for the press to set up receiving stations in such areas remains to be determined. In any event, there will always remain the problem of economically transmitting signals from any earth station to the customer. The television industry does not have quite the same problem. Most of their transmitting stations are in the 100 top market areas and their land lines would therefore have to run relatively few miles.

There is another economic factor which is of interest to the press. Let us assume, for example, that someone wishes to publish a regional newspaper. We have, of course, the technology for transmitting facsimile newspaper pages over satellite circuits. Thus, it would be technically feasible for a central plant to transmit facsimile pages so that the newspaper could be printed in a multiplicity of locations. Whether or not this is economically feasible would depend in large measure on the transmission costs. This raises a question of whether or not there will be regional as opposed to universal rates and, if so, whether these rates will be competitive. The competition here may be stiff if terrestrial microwave companies are successful in getting licenses for their systems.

Another matter of interest to the press, or indeed any potential user, is whether there will be a single management responsible for all ground station operations. It would seem that this arrangement would lead to better continuity of services and would simplify the handling of maintenance, repairs and other problems. It would obviously be highly desirable to do business with a single entity rather than with a large number of management concerns.

In your letter you ask for views particularly on the question of economic viability of the Communications Satellite Corporation. My brief comments above are about all I have to offer in this regard. We do not have any figures on what rates may be. We know, of course, that costs of transmitting signals by satellite over long distances is considerably less than land lines but we do not know how these costs are going to be translated into rates.

You may be familiar with the Press Rate Case, FCC Docket No. 15094. This case has continued for quite a few years. The Hearing Examiner's recommendation was adverse to press interests. The case is now before the FCC for decision. Oral arguments are scheduled for next week. Should the press lose this case, we all will be required to lease circuits for 24 hours rather than for the number of hours we actually need to use them and will not be permitted to share these

circuits. In the case of my Company, our communications cost increase will be over 80%. Other companies will face higher increases and some lower. Obviously, the press as a whole is seriously concerned with finding more economical means of disseminating news.

I happen to be a member of the Communications Committee of the American Newspaper Publishers Association. The Chairman of this committee is the General Manager of ANPA, Mr. Stanford Smith. Our committee has been actively engaged in discussions exploring the potential of a communications satellite system and has been attempting to develop press requirements. If you have not already done so, I suggest that you consult with Stanford Smith.

I thank you for inviting me to express my views. I hope that such as they are they may be of some use. In any event, please feel free to call on me if you feel I can be of any greater assistance.

Sincerely,

ROBERT L. DENNISON.

NOVEMBER 5, 1969.

WASHINGTON.—Top representatives of newspaper publishers and the press wire services expressed strong support today for proposals to share in the use of a COMSAT domestic satellite system for distribution of national news.

The press executives met here with officials of Communications Satellite Corporation (COMSAT). They discussed the scope and potentials of a non-exclusive, cooperative domestic satellite system of high capacity that could serve a variety of U.S. communications users.

The COMSAT system, outlined earlier to U.S. network TV executives, contemplates two in-orbit synchronous satellites, each with a capacity of up to 24 color TV channels, and a network of earth stations.

It would be capable of handling all forms of communications, including teletypewriter, pictures, facsimile, data, voice and TV.

The press representatives authorized a statement strongly supporting the development of such a system, and said they wished to share in the use of it directly for nationwide distribution of news, pictures and newsfilm.

Those attending the meeting were Stanford Smith, General Manager of the American Newspaper Publishers Association (ANPA), Mims Thomason, President of United Press International, Daniel DeLuce, Assistant General Manager of the Associated Press, James Darr, Director of Communications for UPI, Admiral Robert L. Dennison, of Copley Press, Inc. representing the Inter-American Press Association and Donald C. Beelar, Washington communications attorney for ANPA and AP.

Discussions centered on the requirements of the press, and how the proposed domestic satellite system could be used to meet news distribution needs.

COMSAT officials were Chairman James McCormack, President Joseph V. Charyk, Vice President-General Counsel David Acheson, Vice President-Operations George Sampson and Assistant Vice President for Information Matthew Gordon.

In describing the proposed system, COMSAT officials emphasized that it would accommodate not only the needs of the TV networks, but would have sizable remaining capacity to handle any other forms of Communications in a highly economical manner.

COMSAT said it would provide and operate the satellites and major send-and-receive earth stations, plus other stations as required. But COMSAT suggested that receive-only stations in the system might be owned by individual users or jointly by a number of communication users. COMSAT said it remained flexible on how this should be done.

The ANPA, AP and UPI executives said they would seek to discuss plans further with other press groups and confer with COMSAT again when more detailed requirements are formulated by the news media.

COLUMBIA BROADCASTING SYSTEM, INC.,
*New York, N.Y., January 14, 1970.*

Mr. FRANK R. HAMMILL, Jr.,
*Committee on Science and Astronautics,*
*House of Representatives,*
*Washington, D.C.*

DEAR MR. HAMMILL: By your letter of January 9 you requested CBS's views "on the desirability of establishing a domestic communications satellite system, together with any comments or recommendations you may wish to make regarding the current state of affairs."

On September 26 I replied to a comprehensive request for information by Mr. Clay T. Whitehead, who was directing a White House study of "alternative policies for the timely introduction of satellites to domestic commercial communications," setting out CBS's views and conclusions at considerable length. I emphasized the imperative need for a United States domestic communications satellite system and outlined the technical requirements and economic considerations as we see them.

Again, on October 15, in an address before the Audio Engineering Society's 37th annual convention, I urged that steps be taken to break the deadlock in establishing a domestic communications satellite system, and to that end proposed "that ABC, NBC and CBS join in forming immediately a consortium to build and operate a domestic satellite system, with the necessary ground stations, capable of transmitting television and radio programming to all 50 states and offshore islands. I further propose that the Corporation for Public Broadcasting be invited to join this consortium as a fourth member with a voice equal to that of each of the commercial companies in directing the consortium, and that the channels of the system be made available to the Corporation for Public Broadcasting at no charge."

We continue to hold to the views stated in my letter to Mr. Whitehead and in my October 15 address. I am enclosing copies of both statements for your information. I might add as the months go by without resolution of the problems standing in the path of technically feasible and long overdue domestic satellite system, and without evidence that a solution is in the offing, we are becoming increasingly anxious. For this reason we are delighted to see the Subcommittee on Space Science and Applications taking an active interest in what—by any measure—is a very important factor in the growth and development of communications in this country.

With all good wishes.

Sincerely,

FRANK STANTON, *President.*

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COLUMBIA BROADCASTING SYSTEM, INC.,
*New York, N.Y., September 26, 1969.*

Mr. CLAYTON T. WHITEHEAD,
*White House Assistant,*
*The White House, Washington, D.C.*

DEAR MR. WHITEHEAD: We appreciate the opportunity you have given us to comment on possible applications of satellites in the field of domestic communications.

CBS has long been interested in the potential of satellite transmission. We regret the delays which have prevented practical application of a development in which the United States has been the outstanding pioneer and on which our country has made vast expenditures. It would be unfortunate if space communications were used domestically for the benefit of other nations before they are used to serve the nation which developed the new system. We welcome the establishment of your study group and hope that, as a result of its activities, further lengthy delays in this important application of satellites will be avoided.

Another consideration which adds to the urgency of reaching a prompt decision is the World Administration Radio Conference scheduled to meet in Geneva in June 1971. The purpose of the Conference is to obtain international agreement on spectrum allocations and orbital spacing criteria; it probably will set the pattern for satellite utilization for a number of years to come. The American delegation to that Conference should have a clearly defined position, backed by as much technical experience as possible, if the interests of the United States in this important new mode of communications are to be properly represented and supported.

These general observations aside, planning the use of satellites, is complicated by the fact that, despite great progress in satellite technology, further information is needed to insure maximum efficiency in the use of spectrum and orbital space. It is likely that satellite systems designed in 1975 or 1980 will use frequencies, equipment, and techniques presently unproved. However, this is not sufficient reason to postpone the use of existing technology in domestic communications. In fact, application of today's state-of-the-art seems essential to the development of new information and more advanced equipment.

After a period of practical use and when more sophisticated, higher-capacity satellites become available, it may prove more efficient to employ a multi-purpose satellite system carrying traffic of many types—telephone, teletype and data as well as audio and video program material. In the immediate future, however, available satellite designs are uniquely adapted to the program transmission requirements of the television networks. To be more specific:

A satellite is inherently a wide-bandwidth device—and television, unlike most communications, requires wide bandwidths.

A satellite channel is a one-way device—and the great majority of television program transmission is uni-directional.

A satellite can deliver the same signal to many different geographical locations as easily as to a single location—and television networks need to deliver programs to several hundred affiliates scattered throughout the United States.

Satellites can serve areas such as Alaska, Hawaii, Puerto Rico, and the Virgin Islands and other remote portions of U.S. territory—and no other communications system is available to deliver "live" television to such areas.

As to the economics: the television networks offer a large, ready-made market for a domestic satellite system. It is probable that the television networks will provide the major economic support for such a system for a considerable number of years. In fact, the start-up costs of a domestic satellite system are so great and the growth of non-television utilization so uncertain that, were it not for the prospect of serving the television networks, it might be difficult to attract the needed capital.

There is another economic consideration. The rates charged by AT&T for television program transmission are under review and it now appears that these rates may be increased to a level which will force the CBS Television Network and other television networks to consider a substitute for AT&T service. In addition, we are informed that modifications now being made in AT&T's microwave facilities will double the number of telephone channels displaced by a single broad-band television channel—making it less desirable for AT&T to divert telephone channels to television use.

From the social and political points of view, it seems desirable that domestic satellites be placed in service at an early date because of their ability to improve the flow of news and informational programs on the commercial networks, because they could provide economical program distribution facilities for educational and instructional television networks and because of their potential value in delivering messages of national importance throughout the United States in times of emergency.

Without implying support for any specific proposal which may be under consideration at present or which may be made in the future, I believe your working group should indicate that it favors early establishment of a domestic satellite system to provide a more efficient and more economic method of distributing television programs and that proposals by interested parties are invited and will receive prompt disposition. A two-step development schedule might be advisable—the first, what has been termed a pilot operation of limited scope—the second, a full-fledged nationwide system. The first phase would be designed to answer such questions as:

The reliability and quality of transmission on a day-in, day-out basis.

The restraints which may apply in the choice of locations for down-link receiving stations.

The degree to which signal absorption or reflection in areas of heavy precipitation may interfere with reception.

Improvements in design and reductions in cost of ground terminals.

Development of operational experience with a satellite system serving a multiplicity of ground terminals.

Forcing the resolution of problems involving frequency allocations and the rights of other nations.

I hope that these comments will be helpful in your efforts to resolve this very complex problem. If we can be of any further assistance in your studies, please feel free to call upon me.

With all good wishes.

Sincerely,

FRANK STANTON, *President.*

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THE WHITE HOUSE,
*Washington, August 19, 1969.*

Dr. FRANK STANTON,
*President, Columbia Broadcasting System,*
*New York, N.Y.*

DEAR MR. STANTON: The Government is considering alternative policies for the timely introduction of satellites to domestic commercial communications. Our objectives are to assure timely and full benefit to the public of satellite technology potentials and to assure maximum learning about the problems and possibilities of satellite services in domestic applications.

We are aware that CBS has had a continuing interest in this subject. While we have reviewed the public record of the last several years, your current ideas and information would be a useful addition to our review. I would, therefore, like to invite you to submit any information or comments you feel would be helpful to our working group. We expect to complete our work about October 1.

Since the Federal Communications Commission is responsible for authorizing specific operational systems, we will not be concerned with specific corporate proposals or the details of system designs. Rather, our focus will be on the economic and institutional structure of the industry, the relationships between competition and regulation, and how new uses and services can be encouraged for public benefit.

Enclosed are some of the issues we will be considering. You may wish to use these, in part, in organizing your comments. I look forward to hearing from you.

Sincerely yours,

CLAY T. WHITEHEAD,
*Staff Assistant.*

BENEFIT TO THE PUBLIC FROM THE ECONOMIC AND SERVICE POTENTIAL OF SATELLITE TECHNOLOGY

1. What specific services that are not now available would be made possible and economically feasible through satellite technology?
2. What specific services now being offered could be provided more effectively or more efficiently through satellite technology, and what economic savings would accrue?
3. What institutional, technical, and economic arrangements, taken as a whole, appear most likely to assure full benefit to the public of domestic satellite potential?
4. What specific services and systems appear to offer the most immediate economic potential and how can they best be provided?

LEARNING ABOUT THE PROBLEMS AND POSSIBILITIES OF SATELLITE SERVICES

1. What information about technological capabilities and performance of satellite systems is needed to resolve uncertainties about the technical and economic feasibility of potential systems?
2. What information about operational uncertainties is needed?
3. What information about economic and market characteristics is needed?
4. Specifically, what information or technological developments are needed over the next few years with respect to tradeoffs among spectrum utilization, orbit location, and cost to permit maximum utilization of communications satellite capabilities?
5. What of the above information can be obtained best by further research, experimental trials, or a pilot operational system?

INCENTIVES FOR INNOVATION BY COMMUNICATIONS FIRMS TO DEVELOP NEW TELECOMMUNICATIONS SERVICES AND MARKETS

1. What Government policies would be most effective in promoting development of new telecommunications services and markets by the private sector?
2. What research and development can be carried out by private enterprise to speed the development of economically viable domestic communications satellite applications?
3. Is there research that can be carried out only by the Government that would resolve uncertainties or impediments to technological or market innovation by the private sector?
4. Given appropriate economic incentives and institutional arrangements, what new services, markets, or technologies could the private sector likely develop in the foreseeable future?
5. What institutional arrangements with respect to ownership and operation of communications satellites will offer the best balance between the rate of innovation and nondisruptive growth of the communications industry?

DEGREE OF REGULATORY CONTROL AND IMPEDIMENTS TO TECHNICAL AND MARKET INNOVATION

1. What type and degree of economic regulation (such as rate-base regulation, limits on entry of new firms, authorized user limitations, or limits on services offered) is now clearly necessary during the initial phases of domestic commercial satellite communications? What technical regulation, such as spectrum utilization, interference standards, or service standards?
2. Under reasonable projections of the economic and technological potential of satellite services, what regulatory policies appear most desirable for the long run?
3. Is it desirable to have regulatory policies with respect to telecommunications via satellite that are distinct and different from policies for terrestrial systems?
4. To what extent can competition, together with general regulatory guidelines, foster a more responsive industry than is possible with very detailed regulation?

AUDIO ENGINEERING SOCIETY 37TH ANNUAL CONVENTION

(Remarks by Frank Stanton, President, Columbia Broadcasting System, Inc.)

As we enter the 1970's, the U.S. broadcasting industry is within reach of a breakthrough that has already become a household phrase—but so far has had only limited impact on 200 million Americans. I refer, of course, to satellite communications.

When man set foot upon the moon, satellite communications enabled 600 million men, women and children around the world—one-fifth of the world's population—to eyewitness this epic and electrifying event as it took place almost a quarter of a million miles away in outer space.

When Jean-Claude Killy raced down the slopes of the French Alps during the last Winter Olympics, when President Nixon visited Pope Paul at the Vatican last spring, when the Prince of Wales was invested at ancient Carnarvon Castle last summer, millions of Americans sat glued to their television sets watching these events as they unfolded before their eyes. Satellite communications made this live coverage possible.

Since 1965, United States-designed commercial satellites have been relaying television and radio broadcasts, telephone calls, telegraph messages, facsimile and computer data across the Atlantic, the Pacific and the Indian Oceans. A single satellite can provide almost as many circuits as are now available for telephone and telegraph transmissions from the United States to the rest of the world by undersea cable and high-frequency radio.

Satellites able to provide many times the present capacity of these other means of communication have already been designed.

Yet in spite of the successful introduction of satellites to international and space communications, the great benefits of this new technology have so far been denied to the American public for domestic use. The prime loser has been educational television with its nearly 200 stations. These stations, which reap such great benefits from joining forces in educational network operations, have been seriously limited in their use of nationwide interconnections because of the shortage of lines and because of costs. They have been restricted in the degree to which they can rely on centrally produced programs, whose content and quality ought to be seen on a nationwide basis.

Since Syncom II went into orbit in 1963, we have known that a communications satellite could serve domestic as well as international communications. For at least five years we have known that for both technical and economic reasons, one of the most fruitful immediate applications of satellite technology would be domestic television. Satellites would substantially reduce the cost of television transmission, increase its range and improve its coverage and quality.

In so doing, satellites would greatly enlarge the capability of the networks, commercial as well as educational, to serve their affiliated stations—particularly with news and public affairs broadcasts and special events which cry out for live simultaneous coverage—and they would greatly augment the usefulness of networks in national emergencies and for civil defense.

The domestic satellite question has been under intensive examination for years. It has been almost five years since ABC's dramatic proposal of a system which, besides serving its own network needs, would also provide facilities for a truly nationwide educational television network.

By the following summer, not only had ABC broadened its proposal, but others had suggested constructive approaches. NBC presented impressive studies—including the design of a model system—deriving from the comprehensive electronics expertise of RCA. The Ford Foundation's imaginative plan stimulated lively discussion, and for the first time focused the national attention on educational television. COMSAT and AT&T also offered plans for domestic satellite systems. Hughes Aircraft Company provided much of the technical foundation for the other proposals.

Painstaking technical work and great ingenuity went into the many proposals of 1965 and 1966. But to what avail? Now we are into the fifth year of discussion, analysis—and bureaucratic inaction.

What a national waste.

For not only are there no insurmountable technical or economic problems, but the three main users—ABC, NBC and CBS—are in clear consensus in favor of a single purpose domestic satellite system constructed and operated by private industry. Broadcasters want to cross the threshold into the era of satellite communications and cross it *now*.

Our news operations, our creators of entertainment programming, our affiliates, our stockholders—but most of all, our audiences—all have a common interest in development of the best possible broadcast system that technology can provide. Moreover, such a system need not cost the government or the taxpayer a cent—either in capital outlay or in operating costs.

What is needed is a meaningful move to turn consensus into concerted action. To that end, I propose that ABC, NBC and CBS join in forming immediately a consortium to build and operate a domestic satellite system, with the necessary ground stations, capable of transmitting television and radio programming to all 50 states and offshore islands. I further propose that the Corporation for Public Broadcasting be invited to join this consortium as a fourth member with a voice equal to that of each of the commercial companies in directing the consortium, and that the channels of the system be made available to the Corporation for Public Broadcasting at no charge.

We estimate that the cost of putting the satellites in orbit and building the ground segments of the system would be something on the order of $100 million, and we propose that ABC, NBC and CBS share equally in the cost. If Washington could only be moved to prompt approval, the system could be in operation as early as 1972.

A recent 44 percent jump in the charge for AT&T's domestic transmission over its land lines and microwave systems makes an early start on a satellite system imperative. We have already waited many years for the Federal government to formulate its position on a domestic system. And we are still waiting. But AT&T has not been waiting. AT&T has increased its annual charges for network television interconnection by $20 million—bringing its total yearly charges to the three nationwide television networks to $65 million.

We all recognize that AT&T has serious problems, including rising costs. But for whatever the reason, because of the costs levied on the networks we lease AT&T lines only for ' ' to 18 hours a day. With a satellite system at our disposal, we could afford to transmit around the clock. We could provide live network broadcasting to Alaska, Hawaii, Puerto Rico and the Virgin Islands, which now have to settle for delayed programming.

How soon we shall be able to do all these things depends on the Federal government's decision with respect to the ownership of domestic satellites. We are very much encouraged by the fact that President Nixon has taken a special interest in the subject. In August, as you know, he set up a White House panel under Clay Whitehead to review the issues and invite comment and suggestions.

And high time. By 1972, our neighbors in Canada expect to have in operation a satellite system which will beam telephone, television and other communication services to all parts of that vast country. On the opposite side of the globe, a satellite orbiting 22,300 miles above the Indian Ocean will beam educational television programs to relatively inexpensive receiving stations in 5000 villages in India.

At present, India has virtually no television. American space technology will, therefore, enormously aid her efforts to instruct her huge population in the essentials of survival—agriculture and population control, for example—and to create a sense of national purpose among diverse and isolated communities.

Japan, Australia, Brazil and Pakistan are busy with plans for their own satellites. In Europe, several organizations are studying the possibility of regional European satellite systems for telephone and television service, and one of them could be operational by 1972. Russia already has an imperfect domestic communications satellite system, although it does not use stationary satellites.

Is it not ironic that the United States, which pioneered in space communications, is so slow in bringing the benefits of satellite technology to its own people? A rhetorical question and one which has been answered by rhetoric too long.

But the impasse can be broken. The nation can and should adopt a policy that will permit large capacity users of satellite communications to have a realistic choice of systems, each one designed for specific needs.

The consortium I am urging tonight provides one such choice—and in an application for which satellites are ideally suited. All we need is the go-ahead. It is in the public interest that we get it.

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TIME, INC.,
*New York, January 20,1970.*

Mr. FRANK R. HAMMILL, Jr.,
*Counsel, Committee on Science and Astronautics,*
*House of Representatives, Washington, D.C.*

DEAR MR. HAMMILL: Your letter of January 9, 1970 to Mr. James Linen requesting Time Incorporated's views on a domestic communications satellite system has been referred to me.

I am enclosing a copy of a letter from Mr. Andrew Heiskell, Chairman of the Board of Time Incorporated, to Mr. Clay Whitehead of the White House staff. This letter, written last fall, expresses Time Incorporated's position on the domestic satellite.

If you seek information beyond the scope of this statement, we will be happy to try to respond.

Sincerely,

BRUCE L. PAISNER,
*Assistant to the Chairman.*

TIME, INC.,
*New York, October 30, 1969.*

MR. CLAY T. WHITEHEAD,
*Staff Assistant,*
*The White House, Washington, D.C.*

DEAR MR. WHITEHEAD: Time Incorporated is pleased at the renewed interest in establishing a domestic communications satellite system. Such a system—if its service is equitably priced and open to all users on a common-carrier basis—will speed and improve the flow of information throughout the United States. We thought it appropriate at this time to make our interest in this matter known to you.

We at Time Incorporated will welcome the availability of a domestic satellite system. Continuing reviews of our requirements indicate that many of our communications needs could be fulfilled more efficiently and economically by satellites than by presently available means of transmitting information. Time Incorporated is desirous of being a customer of the domestic satellite system. We could use such a system in many aspects of magazine production and in a variety of other ways; e.g., transmission of the written and pictorial content of

our magazines to production and printing plants around the country; maintaining our extensive subscription services; transmission of information required by our Selling Areas Marketing Information division; servicing our growing cable television operations. The foregoing are by no means all-inclusive. We are continually finding new ways to use satellites to increase efficiency and lower costs in transmitting the information which is the basis of our business.

The domestic satellite system is particularly important to Time Incorporated because it will make possible a rational and equitable system of charges for service. Since distance is not a factor in computing the cost of transmitting information via satellite, this system will permit a rate structure independent of distance. Consequently, the new satellite system will enable us to transmit large amounts of information over long distances more cheaply than is possible through existing land-line systems.

But if this and other desirable results are to be achieved, and if the domestic satellite system is to be equitable and non-discriminatory, it must do the following:

1. From the outset, the satellite system must be a common-carrier. We believe that whoever owns the satellite should make it available at established rates to all who wish to use it. Access to the satellite cannot be limited to any particular group or class of users. The common-carrier principle has characterized the history of American communications, and should be a basic tenet of the new satellite system.

2. The rate structure must be based on the unique technological characteristics of satellites. As noted before, the cost of transmitting information via satellite is not a function of the distance involved. Hence distances should not be a factor in computing rates. Charges for the satellite should be based on the amount of time it is actually in use. The minimum charge should be as low as economically feasible in order not to discriminate against customers with smaller volumes of material to transmit. A reasonable rate structure would include the costs of building, launching and maintaining the satellite and essential ground equipment, plus a reasonable profit for the satellite owner.

3. A common-carrier operator of the satellite system must be authorized to sell time on the system directly to customers who are bulk users. Such bulk users should not have to purchase time on the satellite through an intermediary communications company or common-carrier. Of course, existing, ground-based carriers would be free to purchase time on the satellite for the benefit of their own customers. Such ground-based carriers will continue to be the main source of terrestrial linkage between the satellite and the ultimate destination of transmitted information.

4. Customers of the satellite system must have the option of establishing, owning and operating their own ground stations for transmission between earth and the satellite. Such flexibility is imperative if users are to receive maximum efficiency and economic benefit from the satellite system. Appropriate Federal regulatory agencies should formulate high enough standards to ensure that such stations are equipped and operated in harmony with the rest of the system.

Since Time Incorporated's interests are involved, we hope to participate in future discussions about the domestic satellite system, and to be consulted at appropriate times.

Sincerely,

ANDREW HEISKELL.

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JOHNSON & JOHNSON,
*New Brunswick, N.J., January 23, 1970.*

Mr. FRANK R. HAMMILL, Jr.,
*Counsel, Subcommittee on Space Science and Applications,*
*House of Representatives, Washington, D.C.*

DEAR MR. HAMMILL: Thank you for the opportunity presented by your letter to express our views on the question of desirability of a domestic communications satellite system.

As large scale users of all forms of domestic communications services at our many locations throughout the country, we have an interest in the direction which will be taken to supplement existing service. We believe that the variety of services provided by the existing carriers have been maintained, and new services implemented, at a high level.

In the present competitive communications environment, we would assess any services offered at competitive rates, consider their effect on our present and projected needs, and evaluate the effect on the communications procedures of our organization.

I am sure the Subcommittee, following its assessment of all factors, will determine and recommend appropriate action on the use of satellite systems as domestic communication vehicles.

Very truly yours,

JAMES T. STEWART,
*Manager, Telecommunications Administration.*

Mr. PETTIS. Mr. Chairman.

Mr. KARTH. Mr. Pettis.

Mr. PETTIS. What about the category of user that is not maybe in the free enterprise system, such as the school systems? I was talking to some people in education, after we had gotten into these hearings, and they are very much concerned about our lack of teachers, particularly in remote areas, teachers of all kinds, but particularly in the area of science. It wouldn't take very many professors at $10,000 a year to pay for one of these stations.

This is, of course, one of the problems our society faces today, the problem of bringing the level of education up to where our young people are prepared for today's society. Otherwise we are going to have bigger and bigger problems of welfare and all the rest.

I would hope that maybe in Alaska and in our own United States we might be able to supplement our teacher reservoir by the use of satellites.

Dr. CHARYK. I think that is an extremely important observation, Mr. Pettis, and in that direction, we have indicated to the educational interests that if we were to have the responsibility for developing such a satellite system, we would make two television channels out of the 24 available on a nationwide basis for educational purposes at no cost.

Mr. PETTIS. While I have the floor I would like to ask you a question. Are you aware of a program conducted by the Ford Foundation a few years ago, in the use of videotape to teach high school physics without benefit of a physics teacher in the classroom and just using the video tape?

Dr. CHARYK. Yes.

Mr. PETTIS. Their conclusions were very favorable to this kind of educational program.

Dr. CHARYK. I think the potential is very great, and I must say that in the discussions that I have had around the world with heads of state who are getting into the satellite communications business for the first time, particularly in South America, one of the first questions that they always ask is, what will satellites be able to do to solve the educational problems that they have in their country?

I think that the reason that we have as many as 70 countries participating in Intelsat is a basic belief on the part of these countries that satellites offer them something new and different, not simply high-quality communications between that country and the rest of the world, which they have in most cases never enjoyed and which is important for the commercial and economic growth of that country, but beyond that, their belief that satellites' may in fact provide the answer to the desperate educational needs that they have.

I think it is a rather remarkable thing, while I am on that subject, that the international consortium has grown to embrace 70 countries,

particularly when one recognizes that there is more involved than simply becoming a signatory to the agreements.

We bill each of the 70 countries monthly for their share of the research and development, the share of the launch costs, the share of the costs of building and operating the satellites, and to have an enterprise where 70 countries of the world on a regular basis pay their bills, I think, is rather remarkable.

Mr. PETTIS. Does the $200,000 price tag of an earth station inhibit educational use in any way?

Dr. CHARYK. Not at all. I would hope that a station that would be established in a given metropolitan area would be interconnected, not only to the commercial television stations in that metropolitan area, but to appropriate educational outlets.

Mr. PETTIS. And this would be true of the developing countries as well?

Dr. CHARYK. The $200,000 earth stations, of course, refer to the domestic system that I have been describing. The situation is different on the international scene.

Mr. PETTIS. Thank you, Mr. Chairman.

Mr. KARTH. I have just two final questions, Doctor.

Yesterday Mr. Hough in his testimony said something that is certainly intriguing to this committee, because for all practical purposes, we don't want to suggest to the Congress or to other committees of the Congress that they take action in support of a new and different communications system, if before that system becomes operative and the economic benefits to be derived therefrom, if any, are applied to the consumer of the country, might find that some even newer and more efficient communications device would come along. On page 1 of his statement, Mr. Hough makes a very provocative comment, and I will quote, "Looking to the future, waveguides and lasers also appear to hold great promise for carrying large volumes of communications at very low cost.

"Accordingly, a possible domestic communications satellite system must be considered as a part of a highly developed nationwide network, and in comparison with other attractive transmission media."

Now, implicit in that statement, is Mr. Hough's judgment, that waveguides and lasers would be less costly even than communications satellites. So my question is, I would like to have you direct a comment to that, and also give me the benefit of your judgment as to when waveguides and lasers might be applied to the communications network in this country.

Dr. CHARYK. Well, I would first make the observation that waveguides and lasers, of course, only interconnect two points. I would think that the initial application of the waveguides would be in providing very high capacity communications within a limited area.

Personally, I look ahead to a situation where the places of business within a given metropolitan area would be interconnected with very high capacity communication links. Waveguides, and ultimately lasers, may be an ideal way to provide huge capacity between various users within a given metropolitan area.

But as one moves from one metropolitan area to another, it is my belief that in the future this will be done more and more through satellites. In other words, we will have a vast interconnection network

within a given metropolitan area, but that metropolitan area will be able to be connected to any other metropolitan area in the world through the earth station that serves that metropolitan area, a satellite in orbit, and an earth station serving the metropolitan area at the other end.

I think that waveguides and lasers initially are going to find their greatest application in short-distance interconnections, involving requirements for huge amounts of capacity, and that satellites are going to be the means of interconnecting metropolitan centers throughout the world.

So I think they are going to end up in rather complementary fashion, and not as competitors.

Mr. KARTH. How far in the future do you see the applicability of waveguides and lasers, Doctor, for whatever advantage they might have?

Dr. CHARYK. This is not a field in which I have any great expertise, so my opinion has to be weighted accordingly; but I would feel that we will see application of waveguides to meet communications requirements by the end of the seventies, perhaps on a limited basis at that time, but on an ever-expanding basis in the eighties.

Lasers, I think, are much further down the road.

Mr. KARTH. In the eighties, would you say?

Dr. CHARYK. Possibly in the eighties.

Mr. KARTH. Just one other question, Doctor. I am aware in a general way, of the 30-circuit case that was before the FCC sometime in the past. Did that decision result in increased costs to the American taxpayer, in your judgment? And if so, would you explain how, and to what degree?

Dr. CHARYK. Let me try to present an answer to that in a fairly simple form. The Defense Department had requested from COMSAT and from the international communication carriers, bids for 10 circuits between Hawaii and Japan, 10 between Hawaii and Thailand, and 10 between Hawaii and the Philippines.

The difference in proposal costs was of the order of 3 to 1—in other words, the COMSAT proposal to meet the needs by satellite circuits was roughly one-third the proposals submitted by the international communication carriers.

The international communication carriers had submitted quotes at a price that was essentially the going price at that time for cable circuits, and we submitted a proposal to provide satellite circuits at one-third.

In the case of COMSAT, at about $4,000 per half-circuit per month, and about $12,000 in the case of the communication companies.

At that point, the international communication carriers appealed to the FCC on the basis that the Communications Satellite Corp. should not be permitted to deal directly with the Government, that the Communications Satellite Corp. under the act was simply a carrier's carrier, and could provide service only or should be allowed to provide service only to the communication companies.

The end result was that their position was upheld, and COMSAT was restricted from dealing directly with the Government, but a new compromise price was reached whereby the Government was to have access to the circuits at a price of $7,100 per half-circuit per month.

So that what happens now is that we sell a half-circuit to the international communication carriers for $4,000, and they sell it to the Government for $7,100.

Mr. KARTH. And on a 30-circuit basis, the additional costs to the Government are?

Dr. CHARYK. It is about $3,000 per circuit per month, times 30.

Mr. KARTH. $1 million plus a year.

Dr. CHARYK. Yes. Now, just to present this fairly, as a result of this, the cost of cable circuits, of course, is also at $7,100, so that whereas the Department of Defense was previously paying roughly $12,000 for the cable circuit, as a result of this compromise solution they now have access to cable circuits on those comparable routes for $7,100 instead of the $12,000 which they paid earlier.

So that $7,100 is now a composite rate. It doesn't make any difference whether it is a cable circuit or a satellite circuit, the price is the same. On the other hand, I think the original proposals indicate the significant cost differential between a cable circuit and a satellite circuit, so in one sense you might say that satellites are being used to subsidize less efficient facilities.

Mr. PETTIS. Mr. Chairman.

Mr. KARTH. Mr. Pettis.

Mr. PETTIS. Could you make a projection of what you feel satellite lifetime in orbit will be in the 1970's and 1980's? This will have a great bearing on the economics of the thing, as I look at it.

Dr. CHARYK. It is a very difficult question to answer. When we first designed the Early Bird satellite, we hoped for a useful lifetime of about a year and a half. The Early Bird satellite is still operational, and it is now roughly 4½ years that the satellite has been in orbit.

Our second generation of satellites were designed for 3-year lifetime and they are all operating. The third generation was designed for 5 years, and of course it is still early in the game, but we have no reason to feel that this is an unreasonable guess as to useful lifetime.

I personally think that the real limitation is going to be related to the advance of technology. In other words, after a period of about 5 years, a particular satellite is going to be relatively obsolete. It may still be working, but it is not the most efficient thing to use because by that time the technology has moved ahead, much more efficient satellites are available, and it is better to use a newer one with much higher capacity, much greater capability, and simply retire the satellite in orbit.

Mr. PETTIS. You can't do with them as we do with our old taxicabs, sell them to somebody else?

Dr. CHARYK. You just have to leave them there, and they do become spares, of course, in the event that some difficulties should arise in your newer series. And as a matter of fact, this is exactly what happened in the case of Early Bird. When we had a certain amount of trouble with our new INTELSAT III in the Atlantic we brought the Early Bird back into use. And it performed very well for a limited period of time, in helping to restore some of the service which otherwise could not have been restored.

Mr. PETTIS. Do you anticipate the feasibility of working on these or maintaining them in the 1970's or 1980's?

Dr. CHARYK. I don't foresee the time when we will actually be going up and repairing the satellites. As far ahead as I can see, it is always going to be better to simply replace the satellite, and more realistically what probably is going to happen is that we will want to lanuch a new one anyway because it is going to be so much more efficient than the older one even if the old one is still operating satisfactorily. If one should actually fail, rather than repair it, we will certainly want to put a new one up that embodies the latest in technology. It will have a greater capability and undoubtedly its economics will also be even more attractive.

Mr. PETTIS. Then one of the values that some of the people talked about in these space stations is really not as important as it might appear to be on the surface.

Dr. CHARYK. I really don't see it, insofar as communication satellites are concerned, certainly for the foreseeable future.

Mr. KARTH. In your judgment, Doctor, does it make sense to permit all domestic carriers to have their own satellite systems?

Dr. CHARYK. Certainly in the early stages, I don't feel that more than one satellite system could be justified. A satellite system such as I have described can handle all the needs that we know about, and can do so on a more economic basis for all users than could possibly be the case if there were multiple systems in operation.

So I think that it is quite important that certainly in the early years, there be only one system and that system be designed in such a way as to meet the requirements of all users, because only in that way we are the full economic benefits going to be enjoyed by the wide spectrum of users.

Mr. KARTH. If all domestic carriers were allowed to use satellite systems, whatever the number might happen to be, would this in the final analysis cause any space spectrum nightmare in terms of regulation? Would that be a fair statement or not?

Dr. CHARYK. It would certainly produce a real mess on the ground, because if you had a variety of satellite systems in orbit, you would need a whole new family of earth stations for each satellite, since a given station on the ground can only look at one satellite at one time. Instead of having, let us say, one station serving the Washington metropolitan area, you would have a separate installation for each satellite system, and this clearly is not an economically attractive course of action in the early years.

Mr. KARTH. Is it proper to conclude that as a result of that, the cost may not come down, but may remain as is, or even go up?

Dr. CHARYK. I think the economics would be seriously in question if you had multiple systems being placed in orbit. I think that the real economic advantages are only achievable by having a system that can serve all the users, and therefore saving not only on the cost of the satellite itself, but saving on the cost of the ground system that has to work with that satellite.

You certainly do not want to double and triple the ground investment costs, which you would have to do if you had separate satellite systems meeting the requirements of individual users.

It would also produce interference problems, it would raise questions as to the efficient use of the frequency spectrum, and would therefore in my opinion be a highly unattractive prospect.

Mr. KARTH. Thank you very much, Dr. Charyk.

Are there any further questions?

Mr. PETTIS. Just one final question, a little peripheral.

Mr. KARTH. Mr. Pettis.

Mr. PETTIS. Have we established standards that will be accepted throughout the world for satellite use? Or will we have that as a problem? When television first came in, Japanese television had a standard, and the French had one, and we had a third. Now, I don't know whether there is any problem of this kind in what we are talking about this morning. Is there?

Dr. CHARYK. There are a number of potential problem areas. We have, for example, established standards for earth stations to use the INTELSTAT satellites. In other words, a station to be accepted for entry into the system must meet certain requirements.

These requirements have been spelled out by the 70-nation consortium. And the system works very well. One of the limitations on the development of satellite technology is the availability of an adequate amount of frequency space. At the moment, we have available for commercial use 500 megacycles up and 500 megacycles down, in the 6,000 and 4,000 megacycle bands.

These bands are also shared, however, by terrestrial facilities, specifically microwave facilities. So that there are limitations on the design of the satellite, which are forced because of interference problems with terrestrial facilities which operate at these same frequencies.

Looking ahead, I think it is going to be extremely important to open up portions of this frequency spectrum where satellites can operate on an exclusive basis, because only then is it going to be possible to realize the full potential.

There is an international conference scheduled in 1971 to deal with this subject, and I think it is extremely important that the United States approach this conference with a well-thought-out position, and work is of course actively underway toward this objective at the present time, and I am sure that Mr. Plummer can expound on that far more efficiently and with greater expertise than I can.

Mr. KARTH. Well, thank you very much, Dr. Charyk. We are most grateful to you that you would again take time to come and benefit us with your answers to our questions, and amplify your previous testimony. Thank you. You have been most helpful, sir.

Dr. CHARYK. Thank you.

Mr. KARTH. Our second witness today is Mr. William Plummer, who like Dr. Charyk was not able to complete his presentation at an earlier meeting. We want to welcome you back to the committee, Mr. Plummer. If you would take the chair at the witness table, sir.

Mr. Plummer, as the record will show, is the acting director of the Office of Telecommunications Management, the Executive Office of the President.

Mr. Plummer, we had to be inordinately brief with you the other day because of the constraints on time imposed upon us by virtue of the fact that the House went into session and we had no authority to continue to sit as a committee.

We wanted you to come back, sir, and give us the benefit of your testimony. If you have others with you who will participate with you as witnesses, I wonder if you would identify them for the record.

## STATEMENT OF WILLIAM E. PLUMMER, ACTING DIRECTOR, OFFICE OF TELECOMMUNICATIONS MANAGEMENT, EXECUTIVE OFFICE OF THE PRESIDENT

Mr. PLUMMER. Well, they were identified the other day, sir. One was Mr. Clark on my right, the Associate Director of the International Telecommunications Directorate. Colonel Olsson on my left is in the same office, working on satellite communications. Mr. David Hall, National Telecommunications, primarily concerned with the National Communications System and domestic matters.

Mr. Richard Gould, immediately behind me, works on communications satellites and on advanced telecommunications technology. I may call upon these gentlemen depending on what the questions happen to be.

Mr. KARTH. Fine. You use your own judgment in that regard.

Would you care to give any additional testimony, sir, at this time? And then the committee may well want to resort to a question and answer period.

Mr. PLUMMER. I had a couple of points, sir, I thought might be helpful for the record. They haven't been touched upon before.

One is what we have been talking about; distribution of television programs through the use of satellites, is by definition in what we call the "communication-satellite service" for which frequency bands are allocated.

If one of the networks wants to send a program across the country, it uses the commercial fixed system. The transmission of programs is affected greatly by economic considerations. I am not an economist, but there are certain things that are obvious to a communicator.

If a program originates say, in New York, for tranmission to the rest of the country, other functions must be performed, for example, circuits must be switched to interrupt the program to put on local commercials.

Normally the network is switched to some central point, the commercial is put on, and then the program is resumed from the originating point. On Saturday and Sunday afternoons, particularly at this time of year, when football games are on, much switching takes place. I am told that there are far more than 24 different television program networks in existence at any one moment during the afternoon or the evening when these games are on. I don't have the precise number, but it is considerable.

The present distribution system uses Television Operating Centers (TOC's) where engineers of the carrier, A.T. & T. Long Lines Department, watch the program at all times, as it goes out over the network. If trouble develops, these engineers take the necessary action. Even when the program reaches all the TOC's it is still no good if it stops there. It has to get to the studio, so terminal equipment is required and links are needed from the TOC's to the studios of the broadcasting stations and their transmitters.

My estimate of the cost of what you might call "trunking" or the "long-haul" service between New York and, say, San Francisco is perhaps a third of the total charge that the network would pay for handling the entire program between these two cities. The rest of that charge is for the use of terminal equipment, the TOC's, the switching, and the links to the stations.

The networks could change their method of operating and perhaps eliminate some of that cost, but if they followed the present system you have to look at the whole of the system, not a piece of it, when you make cost comparisons between the present terrestrial system and a satellite system.

That one-third estimate I gave is subject to verification from the telephone company and the networks who pay the bills.

Another related factor has been touched on just briefly a minute ago by Dr. Charyk, the electromagnetic environment. If you start to site earth stations within the United States, around the cities, you would want to keep each as close to the city it serves as possible. You have to look at what existing microwave systems there are in the area, how their beams are directed, and whether there are any radar in the area.

Unfortunately, we still have a lot of World War II radar, which are rich in harmonics and the third harmonic of one, that is usually referred to as the L-band radar, unfortunately falls right in the frequency band that is received from satellites.

We ran into that problem in Hawaii where there was a radar shared jointly by FAA and the military, about 13½ miles from a proposed earth station. The radar was on a mountaintop looking right down at the earth station.

It was necessary to put in expensive filters and adjust the radar to peak performance. In that instance, somebody had slipped and hadn't filed an application for authority to use the radar. So instructions were promptly issued that the assignment "might" be made upon application, subject to reducing the signal intensity of the harmonic frequency at the earth station site to a level that could be tolerated by the earth station.

That is the first instance of such a problem, to my knowledge. To provide guidance for the future, our office issued a policy statement placing the burden of avoiding or correcting interference from spurious emissions or harmonics on the transmitter operator, except in the case where somebody deliberately locates close to an existing emitter. All of these factors have to be taken into account. They are quite important.

Broadcasting to community stations, also by international definition, would be in the broadcasting satellite service, because the programs are intended for reception by the general public. There are today no frequencies allocated for this service.

We do intend to make proposals to the forthcoming World Administrative Radio Conference for experimental satellite broadcasting. Again the electromagnetic environment is important. I won't elaborate upon that, except to emphasize that you can't impose broadcasting from satellites onto the existing terrestrial broadcasting service without causing interference.

You have to have exclusive channels in a given area or you have problems. Also, the reaction of the other countries must be considered. Rightly or wrongly, other countries don't want us, or any third country, transmitting information programs (which they would call propaganda) to their people. There has been quite a bit of discussion in some of the international forums of how this service should be controlled. Other countries have even stated that they would not allow

space broadcasting unless the recipient country agrees or is allowed to censor the program. This has little to do with domestic satellites but it is an important point to keep in mind.

I think with that, I would be glad to answer any questions you might have, if I could help.

Mr. KARTH. Mr. Pettis.

Mr. PETTIS. I would like to begin by asking, while it is fresh on your mind, if you agree with everything that has been said thus far this morning? Maybe you would like to elaborate on some of the points made in answer to questions?

Mr. PLUMMER. I think it would be inevitable, Mr. Pettis, that I would agree with much of it and disagree with some of it. I didn't make notes of particular points, however.

Mr. PETTIS. Well, if anything sticks out in your mind of anything you would like to make an observation——

Mr. PLUMMER. Well, some of the points I have already covered in mentioning cost considerations. You have to look at all the elements of a system.

Mr. PETTIS. Right.

Mr. PLUMMER. I think it is probably worth a general observation that in about 1958 the Senate had a committee appointed under Dr. Bowles; he observed that out of 143 witnesses, not a single one represented the public.

Everybody who testified was representing some particular interest or user group. We feel that one of our responsibilities, is to look out for the people—the public. Of course, it is not our sole responsibility. We are primarily concerned that the Nation have the best, most reliable, highest quality and most economic communications that it is possible to give the people of the United States.

We are also vitally concerned that communications systems will meet the needs of the military for national security and defense, and for all Government operations. So for those reasons, if no others, we would hope that whatever is developed in the use of satellites will be approached from a systems point of view; be integrated and supplement existing systems, not be completely separate.

To cite a case in point, for some years now there have been what have been referred to as private microwave or right-of-way microwave systems. Our office looked into such systems in 1953 and 1954, as did the DCA in the Department of Defense in more recent years. We found there was no feasible way to interconnect those systems to make another national system for use in time of emergency, because of their differing designs.

We would like to see standards adopted so that as new methods and new systems are brought into being, they will at least be capable of being interconnected in time of emergency, to give the country a greater overall telecommunication capability.

I certainly feel that satellite communications has a role in the United States. I don't want to go too far into that at the moment, because the question of domestic satellites is under study within the President's immediate office, and it would be premature or presumptuous of me to say anything at this point.

I look upon Alaska as being a unique situation. The communications system there was designed to meet military needs. It was not intended to be a system such as we have in the lower 48.

We need better communications in Alaska. The move toward selling the ACS was a move in that direction. I certainly see a role for satellites there. The approach I would like to see, however, is to determine first the requirements—to determine what the real needs are. Then systems analysis can determine the best way of meeting those requirements at the least cost. From that point we can go on to develop the most suitable system. We should not use some technological advance just because we have a new gadget and want to use it.

Mr. PETTIS. Is there any possibility, or do you feel, that satellites may become a factor for peace? We have talked about the military factors and the defense of our country.

Mr. PLUMMER. I think it can be. On the other hand, it can also do harm in the sense that people get false news too quickly and react too fast before they find out that it is false. I think, overall, it is of benefit to people.

Mr. PETTIS. I wasn't thinking about the communications standpoint as much as I was the ability, by use of these satellites, to know pretty much what is going on throughout the world. We don't need U–2's any more and some of our intelligence equipment of the past, and this of course is known to the world.

And we know the same about other nations. This would seem to me to be a factor that would maybe be a deterrent to war.

Mr. PLUMMER. I think I can answer that yes, and very certainly. I can't go into any detail on the subject.

Mr. PETTIS. Yes.

Mr. PLUMMER. I can say that at one of the recent meetings of the International Radio Consultative Committee, there was objection to earth resource satellites being discussed because some countries were suspicious of what we were going to do with them.

Mr. KARTH. Of course, at the same time there are more countries that exhibited a beneficial interest in earth resources than in any other space project that this country has initiated or has become involved in.

Mr. PLUMMER. I think that is correct, sir. As the other countries get more information and learn what it is we have, as we are able to explain the benefits to them, and that we are not going to control or censor the information, then we will get more supporters and be able to get what we think we ought to have.

Mr. PETTIS. Do you share Dr. Charyk's feelings about the educational uses of television?

Mr. PLUMMER. I have mixed feelings on that, sir. First, let me say I don't know enough about it. But it has been my impression that the educators aren't agreed among themselves about the advantages of educational TV—of having real-time programs brought to them. I don't think they know what the requirement is yet. Certainly the studies we have seen have not indicated they really know the requirements, how they are going to operate, and what the total costs are going to be.

My personal feeling is that they need to do much serious thinking and planning—perhaps some experimenting—to learn about the problems of programing such a service, the operating methods, what type of programs to put out, and how often to transmit them.

Certainly elementary arithmetic doesn't have to go by satellite; it hasn't changed very much over the years except for the new math that came in a few years ago. These are things that don't change very rapidly and could be done by textbook. There are matters of world interest where you have to have immediate access to get the benefit from it.

It was mentioned earlier, we don't have enough science teachers. You could take advantage of a few excellent teachers to bring high-level instruction to a large number of people by means of satellite communications—or any interconnecting system; but it doesn't have to be done by satellite.

Mr. PETTIS. I have often thought that this could be used rather advantageously, as we all look back at our own education, the really superior teacher is a rare commodity. We all have had the experience of a teacher who taught just the facts of the course, but he also had an ability to motivate the student.

Now, some of this comes through in television or even in things like videotape, and one of our problems today is motivating the younger generation to be really interested in a physics course or whatever else. If you can find a really superior teacher in the field of physics, it could make a difference. My son is going through this physics business now, and he isn't much interested, and I am inclined to believe maybe if he had a really superior teacher who could motivate him this might help.

I am wondering if maybe by getting a few good teachers that we might upgrade the level of education and particularly in these remote areas that cannot attract teachers. The same way with public television programs. Where you can't attract some of these people to the remote areas.

We had some of these shown to us on the map of Alaska earlier this morning. You can't get the public help in some of those areas very readily. You can't get good teachers to teach even English, much less science in some of these little high schools in the Dakota's and up in other sparsely populated areas of our country.

And this is where I was thinking the satellites might come in.

Mr. PLUMMER. Well, you are so right on that. We established the national radio quiet zone down in West Virginia some years ago, and I am told now they have trouble getting scientists to go down there because it is removed from the cities.

It isn't very far away, but they don't want to go down there and do their work. The Federal Government some years ago got into educational television in American Samoa, and I understand it has proved to be very useful.

Getting away from physics for a moment, let me remark that if you have a man like Bishop Sheen, Billy Graham, or Dr. Bauman here in town, they can attract a wide audience since TV, and they can motivate people that the average teacher couldn't.

So I think yes, there is a very real role for educational TV. There is a scheduling problem, however, among others.

Mr. PETTIS. But using those very people, they are very talented in using this medium, you see. They don't have to have the live personal presence, they can do it through this medium of television.

Mr. PLUMMER. That is right.

Mr. PETTIS. And you can teach this way and establish empathy between the teacher and the student. This was what I was alluding to a little while ago when I was talking about this Ford Foundation experiment. They found a great physics teacher, I think, out in Oakland, Calif., and they took him back to New York City, and created an artificial classroom, with students, and he taught this whole course in physics, and it was all videotaped.

Then they took these tapes out into the boondocks to see how well it went over and there was a terrific response. The youngsters out there were able to learn physics better via these tapes than they were with just sort of a half-baked teacher live in the classroom.

Mr. PLUMMER. I think the only question there, sir, is what is the best and cheapest way of getting that man—his presence—to the student. It may be by satellite, it may be by microwave, it may be by videotape recordings.

Mr. PETTIS. Yes.

Mr. PLUMMER. Mr. Clark wishes to say something.

Mr. CLARK. As you well may know, the Ford Foundation poured millions into a midwestern television experiment, in which they used a large aircraft carrying a television station transmitting educational programs for long periods of the day.

The scheduling problem was what finally defeated the experiment, because in an advanced educational environment, such as we have in this country, the ability to use such a system is so dependent on scheduling, and you only have one or two or at the most maybe three channels available, and the experiment was, I understand, generally considered to be incomplete and not successful.

Whereas your use of videotape or movies or something like that can meet this flexibility of scheduling, and you are not tied to a fixed schedule through a satellite or a regular station or network.

Mr. PETTIS. Thank you, Mr. Chairman.

Mr. KARTH. Mr. Plummer, is there any liaison between your office and the National Aeronautics and Space Administration?

Mr. PLUMMER. Yes, sir, quite a bit.

Mr. KARTH. Is there any liaison between your office and NASA as far as it relates to that agency submitting to the Bureaus of the Budget or to the Congress requests for funds for communications research and development?

Mr. PLUMMER. There hasn't been on the budget of that agency or any other agency. It is a problem of size and quantity, and generally speaking the budgets do not identify telecommunication items clearly enough for us to take a look at them.

We are trying to work out something in that regard. If it involves the use of the spectrum, radio frequency assignment, we do work very much closer with the agency. NASA is a member of the IRAC, which is chaired by one of my staff. Agencies bring in their ideas of projects and explain them to us in considerable detail. They are analyzed, as thoroughly as required. ATS was one of those programs. It started out to operate in the 4 and 6 gigahertz bands. At some point, the question was raised as to whether they should continue to operate in those bands or whether they should move up to the Government bands of 7 and 8 gigahertz.

Mr. O'Connell was then the Director of Telecommunications Management. I think it was in November of 1965 or 1966 that he called a meeting of people from NASA and invited the Federal Communications Commission—commissioners and staff—to join him, in a discussion of this question.

NASA explained what they were doing, the cost that would be involved in changing frequency bands at that point, and how much time would be lost. Within a month or so, the Commission communicated its views to Mr. O'Connell, agreeing to use of the 4 and 6 gigahertz frequency bands for five ATS satellites, subject to about six or seven stipulations.

Those stipulations were acceptable to NASA, and we authorized use of the frequencies in that instance. That type of liaison and review goes on all the time in these big projects. About a year ago NASA joined with us—I don't recall the exact figures—I think they put up something over $37,000, and we, something over $40,000, for a contract with the General Electric Co., Missile and Space Division, at Valley Forge, Pa., to look into orbit and spectrum utilization.

We had a very worthwhile report out of that. Then, about the end of June, last year, the Federal Communications Commission contributed another $50,000, to this contractual effort, to look into the economic aspects of such systems. In other words, the trade-offs between having one size earth station and another, one type of satellite versus another, one type of modulation versus another.

We don't have the final results of that effort yet. I brought along a copy of the two-part GE report, if you would like to have that for the record.

Mr. KARTH. With your permission, Mr. Plummer, I would like to have counsel take a look at it.

Mr. PLUMMER. Surely. It is representative of the type of work we sponsor.

Mr. KARTH. And there may be portions of it we would like to put in the record, those portions which are applicable to the inquiry being made by the committee, if you have no objection.

Mr. PLUMMER. Surely.I didn't mean that the whole report should be included, but it might be of use to you, sir.

Mr. KARTH. Thank you very much.

Mr. PLUMMER. Mr. Gould had another instance he wishes to mention.

Mr. GOULD. I can think of a specific instance in this area where we dealt closely with NASA. NASA was about to fund a study on the use of large satellites in future years for specialized service, such as data transmission, as well as telephone and television. They specifically sought the advice of our office to help shape the work statement so that the results would be useful to us. We did that; we have been informed regularly by NASA of progress; we have been invited to the briefings by the contractors; and we will, in due course, get the final report, which will be useful for our purposes as well as for NASA's use.

Mr. KARTH. Well, without any sarcasm whatsoever intended, I would hope that the Office of Telecommunications Management and the Executive Office of the President could probably cooperate with NASA more frequently, and to a greater degree than they have in the past, since I am somewhat of the opinion that NASA, like so many others, do not

really have as a primary objective or for that matter even a secondary objective, the good and welfare of the public at large at heart.

NASA is a very able agency of the Government, pretty well dominated, I think, by professional scientists and professional engineers, all of whom have great scientific curiosity and engineering curiosity at heart; more so, I think, than they probably have at heart the application of the technologies they have been responsible for to the benefit of the public.

And I don't say that in any critical sense whatsoever. I think they have a responsibility and have carried out that responsibility in very able fashion. On the other hand, I would hope that they would be stimulated by an office such as yours, Mr. Plummer, to give greater attention to the applicability of these new innovations and new technologies that are developed as a result of their spending taxpayers' dollars to the benefits of the public.

If that is possible, within the framework of your office, I certainly would encourage you. I think that it is something that the American taxpayer has a right to expect. How do you, Mr. Plummer, evaluate the effectiveness of the responsible agencies without the executive branch in developing telecommunications policy?

Mr. PLUMMER. I would say it is good. It can be much better. It is a very involved process. I don't know whether you have available a copy of an extract from the manual I gave counsel the other day. But in the very first part of chapter 2, a description of the development of national policy is given.

It is a complicated process. While there are problems, we have managed to work out many of them. The policy stems first from actions of the Congress—the laws it enacts—and pronouncements by the President.

Then, of course, by the Federal Communications Commission, within the private (or non-Government) sector, and by our office within the executive branch. Now, those two, private and executive branch, may cross over at times, and impinge on the same area. If it is completely within the executive branch, we can develop policy.

Chapter 2 goes into that. It isn't perfect. We need a lot more of it. The Commission, has stated—and I don't know whether the FCC changed its view—that it can't make policy in a vacuum, it makes policy in its day-to-day actions as individual cases come before them.

I think there have been some instances where the FCC has gone beyond that a little bit; but it should speak for itself in that regard. It is a responsibility of both—the executive branch and the FCC—to develop national policy.

It gets to be extremely difficult, so many people and views involved, and it is very time-consuming. I wish there were a better way of doing it, but in our system of government with its separation of powers and its free enterprise system, I can't suggest a better way at the moment.

Frequently we are confronted with about the same thing that happens between the House and the Senate, when you have a bill on a similar subject, and there are strong views on each side. There is no referee over you to decide one way or the other. Neither do we have a referee over us, except in a couple of cases where we have gone to the President.

Mr. KARTH. Without exception, to my knowledge at least, the two houses have been able to iron out their differences. Sometimes it takes a little longer than others. But it usually doesn't take years; it doesn't take months. Sometimes it does indeed take weeks. Most often, though, I think it takes just a matter of days, and whatever clairvoyance might occur to either one of the two bodies, agreement is reached.

Those of us who are Members of the House don't necessarily like what the Senate might do on occasion, and I am sure the reverse is true. A policy is established, an agreement has been reached, and if it doesn't work, why, hopefully the Congress will take a look at it the following year or so and make some adjustments.

I am not saying to you that the Congress of the United States is faultless or anywhere near perfect, because that would be certainly an overestimation of the fact. On the other hand, I don't know that I would want to say that the Congress is less effective in that area than some of these agencies that have the responsibility of determining the public need, and really I think in this regard that is one of the responsibilities of the agency, as you indicated.

Unfortunately, too often congressional committees are not benefited by representatives of the public. They are benefited by the testimony given by those who are representatives of some peculiar special interest, and that is no derogation. But the public has a difficult time, I think, in finding an appropriate body to represent their best interests, and then balance that best interest off with the special interest that have represented their viewpoints before the committees.

And so I think it is true, Mr. Plummer, that all of these questions are difficult at best, and are very involved, and in many cases they are technical, and sometimes I wonder how we arrive at the judgments we do arrive at. On the other hand, I don't think that we can be responsible if we settle for less than striving for perfection, at least, and in this regard I think at least the reports that I have been privileged to read, and other information that I have been privileged to have brought to my attention, indicates that the Federal Communications Commission and in this whole area of telecommunications has been less than what we might desire it to be, in terms of definition and establishing clearly understandable national policy.

For example, take former President Johnson's task force on communications policy. It said on page 25 of that report, and I quote, "Our studies show that neither the FCC nor the Director of Telecommunications Planning," and this may well have been before your time, sir, "has the resources required to discharge their present regulatory and executive branch responsibilities satisfactorily."

I am hopeful and I am sure that the American people are hopeful that that can be improved upon. It has been my information, and this may be in error, but at least it is my information that when the Whitehead group makes their report, they will furnish the information in that report to the FCC, and will not make it public, which again may cause those groups that might have a public interest not to be as well informed, and therefore not able to represent the public as well as they otherwise might be.

It is my information that there is no intention for this White House-level group to delineate their views and as a result of that I think that

some of these studies that are made really don't have the effect that they ought to have. Would you care to address yourself to that?

Mr. PLUMMER. Well, on the first point, I don't know what the intentions are in the White House, whether it be to give it to the Commission or make it public. I do know if it is like everything else that goes on in Washington, it will be in the press in the afternoon.

There isn't much that is kept quiet. But I am not in his confidence. I don't know what they plan to do on this.

Mr. KARTH. I have a White House memorandum, signed by Peter Flanigan, assistant to the President, dated November 6, 1969. I assume that you are familiar with that memorandum?

Mr. PLUMMER. I have seen it, yes, sir.

Mr. KARTH. For the record, who is Peter Flanigan? Other than assistant to the President? What are his responsibilities? What is his association with the Office of the President?

Mr. PLUMMER. All I can tell you, sir, is that he is an assistant to the President. I know nothing more about his position or responsibilities, sir.

Mr. KARTH. Does he have a well-recognized background in the field of communications?

Mr. PLUMMER. I don't think his background was in communications. I recall seeing a magazine profile which connected him with Dillon, Reed & Co. I am not that familiar with his background.

Mr. KARTH. Is he the one that is primarily responsible for this memorandum? Or is he just the one who brought the pieces together after it had been compiled by others who might be more expert than he in the field of telecommunications? Do you know?

Mr. PLUMMER. I have no knowledge on that except what is in the last paragraph, I think it was, in his memo, that they had had the advice of—I believe he said the Bureau of the Budget—and the Ashe committee, the President's Advisory Council on Executive Organization.

Mr. KARTH. I am going to ask that this be made a part of the record, for whatever perusal the committee and the Congress want to make of it. In addition, if the final report of the Whitehead Group becomes available in time, I shall insert it in the record at the close of today's hearing. And if you would like to, sir, I would suggest that you, in the next week or so, may comment upon any part of it, because I think you ought to have the opportunity to do so.

Mr. PLUMMER. I think it would be premature for me to comment on it, sir. It was not referred to me for comment, although I have seen it. It was under consideration within the President's immediate office. I don't believe I should comment beyond that.

Mr. KARTH. I see.

THE WHITE HOUSE,
*Washington, December 6, 1969.*

**Attached are:**

**(1) A discussion of the executive branch organization for telecommunications and a recommended reorganization.**

**(2) A description of the responsibilities of a new Office of Telecommunications Policy.**

Both the Bureau of the Budget and the staff of the President's Advisory Council on Executive Organization have assisted in the preparation of this recommendation. We would like to have your comments before submitting a final recommendation to the President. I would appreciate having your comments by December 13.

PETER FLANIGAN,
*Assistant to the President.*

EXECUTIVE BRANCH ORGANIZATION FOR TELECOMMUNICATIONS

In spite of the rapidly growing importance of telecommunications to the Nation and for the government's own missions, there is no effective policy-making capability for telecommunications in the executive branch. The Administration is therefore largely unable to exert leadership or take initiatives in spite of vulnerability to criticism for FCC policies. Government-wide coordination of its own telecommunications activities has not been adequate. These problems have been manifested in several ways:

1. There is a serious lack of effective machinery for dealing expeditiously with domestic telecommunications issues. The government has been grappling for several years, with only limited success, with such issues as "foreign attachments" to the public telephone network, cable TV and pay TV, the possible uses and industry structure for a domestic satellite communications system, and policies for computer communications. There is a current tendency to resolve such issues by past precedents and by compromises between the FCC and various agencies in the executive branch, but the increasingly rapid rate of technological change and introduction of new services makes policy-by-precedent increasingly less relevant, more restrictive, or counterproductive. Neither the FCC nor the executive branch has a significant capability for systematic economic and technical analysis.

2. Efforts to coordinate the procurement and use of telecommunications facilities and services by the Federal government have had limited success. The current coordination arrangements, embodied in the National Communications System (NCS) structure, have achieved certain desirable interconnections and operating procedures, but have not produced the desired assurance that the government is procuring the services needed in an efficient manner. Although present policies call for a "unified" NCS, there is little agreement on what further unification is needed, or what it would cost or accomplish.

3. The current procedures for spectrum allocation are highly inflexible and are increasingly creating a spectrum shortage crisis. The shortage is especially severe in the land mobile radio allocations, which are becoming increasingly important to local police and fire protection services, among many other claimants.

CURRENT ORGANIZATION FOR COMMUNICATIONS POLICYMAKING AND COORDINATION

The Director of Telecommunications Management (DTM) in the Office of Emergency Preparedness is now charged by Executive Order and Presidential memorandum with the responsibility for coordinating telecommunications activities in the executive branch. The DTM also is designated Special Assistant to the President for Telecommunications. However, the history of the organization reveals that attempts by the DTM to exercise leadership in communications policy have been largely ineffectual. The responsibilities and authority of the DTM are questioned by agencies with operating responsibilities. This situation results from a number of factors including organizational location, inadequate staff, and lack of clear authority.

There is now no office in the executive branch with the responsibility or the capability to review the whole range of national telecommunications policies as expressed in legislation and in FCC policies. The Antitrust Division of the Department of Justice has occasionally filed briefs on the competitive aspects of decisions before the FCC, but these derive largely from antitrust considerations rather than from familiarity with communications issues. The Department of Commerce has a telecommunications research capability, but no responsibility or familiarity with communications policy. Neither the Council of Economic Advisers nor the Office of Science and Technology are equipped to address the fundamental economic and institutional problems of the communications industry and its regulation by the FCC, or the problems of the government's own telecommunications.

## STUDIES OF FEDERAL ORGANIZATION

Since World War II, there have been a number of studies of Federal communications organization and a number of reorganizations and shifts of responsibilities within the executive branch. None has proved particularly satisfactory, and, indeed, there is no ideal solution. This is due in part to the quasi-independence of the FCC from the executive branch and in part to the conflicting individual agency mission responsibilities within the executive branch.

The study of the Federal government communcations organization completed in December 1968 by the Bureau of the Budget provides a good statement of the shortcomings of our current organization. The Bureau of the Budget reported a need for:

(1) a strengthened organization for policy planning, formulation and direction of Federal communications activities.

(2) a reorganized and strengthened National Communications System (NCS) within the Department of Defense.

(3) an improved procurement and technical assistance effort in communications on behalf of those Federal agencies which do not now have adequate resources in this field.

(4) a unified frequency spectrum management process.

(5) a coordinated technical assistance program for State and local government in this area.

The recently released report of the Government Accounting Office focused on the government's communications and evaluated the progress toward establishment of a unified National Communications System as directed by the President in 1963. The GAO found a need for stronger coordination of government telecommunications planning, and recommended a single entity be resposible for policy direction and control of the Government's telecommunications systems. The GAO also recommended clarification of what a "unified" NCS is intended to be.

## REORGANIZATION ISSUES

The Budget Bureau study of Federal communications organization made a number of major recommendations and was recently distributed to the departments concerned. Agency views on this study have the common themes (1) that stronger coordination from the top is required in establishing Government policy for its own telecommunications requirements, and (2) that the Federal Government should take a stronger role in the evolution of national telecommunications to deal with the increasingly rapid rate of technological change and industry growth. There is also agreement that a much stronger analytic capability within the executive branch is needed to achieve these goals.

There are a variety of possible ways in which telecommunications responsibilities could be reshuffled or strengthened. As a starting point, there is widespread agreement that a single office should bear ultimate responsibility for:

(1) analyses and formulation of overall telecommunications policy for the executive branch.

(2) policy-level coordination of Federal government procurement and use of telecommunications services and equipment.

(3) allocation and assignment of spectrum resources to government users.

There are several further issues.

The first is where such a single office should be located. There are two competing sets of considerations. Further expansion of telecommunications activities within the Executive Office of the President would force undesirable growth in the size of the Executive Office of the President, while telecommunications does not require the frequent direct Presidential attention implied by a location within the Executive Office. On the other hand, placing the central office within an executive department (e.g., Commerce or Transportation) raises serious questions about the impartiality of frequency allocation and assignment among government users and assurance of vital national security interests. Both sides of this issue have considerable merit, but from the standpoint of practicality and the need to minimize even temporary disruptions of our policy machinery, the policy functions should for the time being remain in the Executive Office. However, as much of the operational and research responsibilities as possible should be carried out in the departments and agencies.

Another issue is whether the authority to allocate and assign frequency spectrum to nongovernmental uses, now vested in the FCC, should be transferred to the central, executive branch policy office.

Consolidation of spectrum allocation authority would permit greater flexibility in assignment policies and eventually, even more efficient spectrum use. However, such a move requires legislation, it raises concerns about political interference in the assignment of frequencies, and it would inundate the new office with a highly routine workload. (The FCC now processes 800,000 applications yearly, compared to 37,000 now handled by the DTM.) For these reasons, immediate consolidation of these responsibilities is not recommended, but planning for eventual consolidation should be started.

A third issue concerns organizational arrangements for mangement of Federal communications networks to implement policy guidance. This is currently done through the National Communications System (NCS) structure. Both the BOB and GAO studies concluded that changes should be made in the NCS arrangements. However, the issues involved are too detailed and too complex to be settled in the context of reorganization of policy machinery. Therefore, the NCS arrangements should not be changed at this time, but should be studied as a priority matter by the new central policy office as soon as it is established. The study would review the objectives, system concepts, organizational arrangements, and effectiveness of the NCS structure, and should include a thorough examination by the National Security Council of national security objectives for telecommunications. Recommendations should be developed for the President regarding the best objectives and management arrangements for overall coordination of Federal telecommunications activities.

RECOMMENDATION

An Office of Telecommunications Policy should be established as an independent entity in the Executive Office of the President. The Director of this office, appointed by the President, would have primary executive branch responsibility for both national telecommunications policies and Federal administrative telecommunication operations. The responsibilities of the Office of Telecommunications Policy would include:

Economic, technical and systems analysis of telecommunications policies and opportunities in support of national policy formulation and U.S. participation in international telecommunications activities.

Developing executive branch policy on telecommunications matters including, but not limited to, industry organizations and practices, regulatory policies, and the allocation and use of the electromagnetic spectrum for both government and non-government use.

Advocating executive branch policies to the FCC, and through the President to the Congress; and representing the executive branch in FCC proceedings.

Exercising final authority for the assignment of the spectrum to government users, and developing with the FCC a long-range plan for improved management of the total radio spectrum.

Reviewing and evaluating the research and development for, and planning, operation, testing, procurement, and use of all telecommunication systems and services by the Federal government; developing appropriate policies and standards for such systems; and making recommendations to the Bureau of the Budget and responsible departmental officials concerning the scope and funding of competing, overlapping, or inefficient programs.

Exercising the functions conferred on the President by the Communications Satellite Act.

Under the policy guidance of the Director, Office of Emergency Preparedness, coordinating plans and programs for testing of and preparing to the use of telecommunications resources in a state of national emergency.

Test, review, and report to the President, through the National Security Council, on the ability of national communications resources to meet established national security requirements efficiently and responsively.

Coordinating Federal assistance to state and local governments in the telecommunications field.

In performing these functions, the Director, Office of Telecommunications Policy, will be assisted by a small staff, augmented as required by: (1) ad hoc, interagency and nongovernment task groups, (2) independent consultants, (3) contract studies, (4) a new Telecommunications Research and Analysis Center, (5) the Interdepartment Radio Advisory Committee, and (6) a new Telecommunications Advisory Committee composed of experts from outside

of the government. So long as the NCS structure is retained, he will also be assisted by the Executive Agent of the NCS.

A Telecommunications Research and Analysis Center (TRAC) should be established in the Department of Commerce, reporting to the Assistant Secretary for Science and Technology. The TRAC would provide a centralized research, engineering, and analysis capability in support of spectrum management and such other areas as may be required. Specific functions of the TRAC would be to:

Conduct research and analysis in the general field of telecommunication sciences in support of other government agencies or in response to specific directives from the Office of Telecommunications Policy, with particular emphasis on radio propagation, radio systems characteristics, and operating techniques leading to improved utilization of the radio resource.

Develop and operate a national electromagnetic compatibility analysis facility under the general policy guidance of the Director, OTP.

Provide the administrative and technical support required by the Interdepartment Radio Advisory Committee. This support will operate in accordance with policies and criteria laid down by the OTP, and will be responsive to OTP requests for information and special frequency assignment actions.

The Office of Telecommunications Policy should be established with an initial strength of up to 30 professionals, including up to 15 at supergrade levels. The position of Director, Office of Telecommunications Policy should be established at executive pay level III. Provision should be made within the budget of the office for adequate consulting fees and contractual support; and for administrative support to, and space for, task groups and personnel on short-term detail.

The Office of Telecommunications Management in the OEP should be abolished. All policy functions of that office not directly related to emergency preparedness should be transferred to the Office of Telecommunications Policy, along with appropriate emergency planning functions, final spectrum management authority, and NCS responsibilities. The major portion of the Frequency Management Directorate of the OTM should be transferred to the Department of Commerce to provide the technical and clerical support functions described above. The position of Special Assistant to the President for Telecommunications should be abolished.

The Office of Telecommunications Policy will exercise the policy functions of the Executive Office of the President with respect to the planning, integration, and emergency use of the telecommunications systems of the executive branch, subject to general policy guidance on appropriate matters from the National Security Council and the Director, OEP. This function will continue to be exercised through the mechanism of the National Communications System (NCS) until such time as changes in that mechanism are suggested by the policy review recommended above and approved by the President.

### RESPONSIBILITIES OF THE OFFICE OF TELECOMMUNICATIONS POLICY

The Director of the Office of Telecommunications Policy develops the executive branch position on national telecommunications policy, coordinates the planning and operation of the telecommunications systems of the Federal government, discharges responsibilities assigned to the President in the areas of spectrum management and satellite communications, and performs emergency planning and control functions for telecommunications.

The Director serves as the President's principal advisor on telecommunications policy, including:

(1) The organization, practices, and regulation of the U.S. domestic and international communications industry.

(2) The allocation, use, and management of the radio spectrum resource for government use, and preparation of recommendations to the FCC on spectrum allocation for civilian use.

(3) The preparation of U.S. positions for international communication conferences, conventions, and organizations.

(4) Federal research and development programs in support of the above.

The Director assures that the executive branch position on telecommunication policy issues is effectively presented to the Congress and to the Federal Communications Commission in the form of legislative proposals, recommendations, and testimony as required.

The Director's responsibilities for the planning and operation of Federal government telecommunications systems include:

(1) Development of government-wide standards for equipment and procedures, as required in the interest of economy or effectiveness.

(2) Evaluation of the ability of national communications resources adequately and efficiently to meet established national security and emergency communications requirements.

(3) Recommendations to the Bureau of the Budget concerning the funding of communications systems and research and development programs.

(4) Preparation of guidelines for the most economical procurement of Federal telecommunications services.

The Director exercises the authority, delegated by the President, to assign radio frequencies for use by the government. He is assisted in this responsibility by the Telecommunications Research and Analysis Center to be established in the Department of Commerce and the Interdepartmental Radio Advisory Committee. He carries out the responsibilities conferred on the President by the Communications Satellite Act. The Director coordinates the development of plans and programs for the mobilization and use of telecommunications resources in an emergency, and prepares to administer national telecommunications resources in the event of war under the overall policy guidance of the Director, OEP.

The Director coordinates assistance in telecommunications matters provided by the Federal government to State and local governments. He appoints scientists, engineers, and economists from outside government to advise on telecommunications matters.

To carry out these responsibilities, the Director must have the following qualifications:

(1) A thorough grasp of the social, economic, engineering, and national security factors which must be considered in formulating telecommunications policies and standards.

(2) Familiarity with telecommunications needs and opportunities of government, industry, and the public, and with the structure of private and governmental telecommunications institutions, both national and international.

(3) The ability to initiate and coordinate telecommunications policy matters on an interdepartmental basis in cooperation with industry and public interest groups, and to define and analyze those key policy issues requiring Presidential involvement.

(4) The ability to direct studies utilizing systems analysis, systems engineering, and economics needed for the systematic analysis of telecommunications policies and opportunities, their impact, their effectiveness, and their costs.

Mr. KARTH. This report says on page 2, and let me just go over this very rapidly, there is now no office in the executive branch with the responsibility or the capability to review the whole range of national telecommunications policies as expressed in legislation and in FCC policies.

Do you agree with that?

Mr. PLUMMER. If it means what I think it does, I think that is probably correct. There is no office that I know of that has the responsibility for policy for the whole Nation, for every aspect of telecommunications within the Nation.

The Communications Act of 1934 divides it between the President and the FCC.

Mr. KARTH. It goes on to say, and I quote:

The Department of Commerce has a telecommunications research capability, but no responsibility or familiarity with communications policy. Neither the Council of Economic Advisers nor the Office of Science and Technology are equipped to address the fundamental economic and institutional problems of the communications industry, and its regulation by the FCC, or the problems of the Government on telecommunications.

Do you agree with that statement?

Mr. PLUMMER. I am not sufficiently informed to express an opinion. I don't know about the Council of Economic Advisers and some of the others.

Mr. KARTH. The recommendations on page 5 of that report, they begin by saying, and I quote—

**An Office of Telecommunications Policy should be established as an independent entity in the Executive Office of the President.**

And then they go on to propose the responsibilities that ought to be included in that office.

I hesitate to keep asking you these questions, and if you defer again I will quit, but do you agree with that recommendation?

Mr. PLUMMER. I can give you a personal view on one part of that, about being in the Executive Office. I think that is the place that it should be, for, to me, very good reasons. If the office is to be effective, it must issue directives to the various Government agencies from time to time, particularly when it comes to assigning frequencies under presidentially delegated authority.

It has been my experience in the Government of some 25 years now that Secretaries of Departments don't take orders from somebody lower in the "pecking order." The Hoover Commission made that point some years ago, and I recall a story that at one time GSA wanted a switchboard that Interior had, and it was settled by which one got to the White House more often.

So to me, there are very good reasons for having the office at a high enough level to get the work done.

Mr. KARTH. Thank you very much. Are there further questions? Counsel?

Mr. HAMMILL. No questions.

Mr. KARTH. If there are no further questions, Mr. Plummer, we are indeed grateful that you would come back a second time and take time out of your schedule to benefit us with your testimony and your answers to our questions. Thank you very much, sir.

Mr. PLUMMER. Thank you.

Mr. KARTH. We are very grateful. The meeting is adjourned.

(Whereupon, at 12:15 p.m., the subcommittee was adjourned.)

THE WHITE HOUSE, *January 23, 1970.*

**The President today announced the Administration's recommendations on the utilization of communications satellites for domestic telecommunications services. The proposals for regulatory policies, which do not require new legislation, were set forth in a memorandum to the Federal Communications Commission. Satellites are currently used in international communications through the INTELSAT consortium, for which the COMSAT Corporation is the United States representative. No satellite systems for domestic service have been approved by the FCC.**

**The Administration's proposals recognize that a flexible regulatory policy is required to stimulate vigorous and innovative exploration and development of satellite service possibilities. It was concluded that Government policy should encourage and facilitate the development of commercial domestic satellite communications systems to the extent that private enterprise finds them economically and operationally feasible, but that there is no reason to call for the immediate establishment of a domestic satellite system as a matter of public policy nor to promote uneconomic systems or dictate ownership arrangements. However, the memorandum does express concern that the delay in adopting appropriate policies should not be prolonged.**

Since no natural monopoly conditions appear to exist in the provision of specialized communications via satellite—such as network television distribution and high-speed data transfer—the Administration recommended relatively open entry and rate competition for such services subject to certain conditions. While the provision of standard telephone services by satellite may or may not be economic at this time, established procedures were recommended to be applied by the FCC for common carriers wishing to establish a satellite system for such use.

The proposed policy—recommended for an interim period of 3 to 5 years—is designed to allow competition to act within well-defined limits necessary to preclude anti-competitive practices and to assure that the competition works toward the public interest. It was concluded that the innovative potential is so great that no highly detailed regulatory process could be flexible enough to realize the potential benefits to the public and the economy that satellites might offer. It was also concluded that, under appropriate standards that could be established by the FCC, the likely use of orbital and radio spectrum resources would be far short of available resources so that systems need not be excluded arbitrarily on conservation grounds. A great deal of flexibility was designed into the policy proposals to accommodate likely technological and economic change and to permit selected policy changes as the need arises.

THE WHITE HOUSE, *January 23, 1970.*

MEMORANDUM FOR HON. DEAN BURCH, CHAIRMAN OF THE FEDERAL COMMUNICATIONS COMMISSION

Federal policy on domestic satellite communications has been long delayed. The Administration is concerned that the delay not be prolonged and that the policies adopted reflect all important dimensions of the public interest, including the international aspects of geostationary orbital and radio resources. Based on our review of relevant technical, economic, and public interest considerations, the Administration offers the following comments and recommendations to the Commission.

PUBLIC POLICY OBJECTIVES

In telecommunications, the government's responsibility to safeguard and promote the public interest involves primarily the encouragement of reliable communications services for public, business, and government use at reasonable rates and the assurance of a healthy environment for continuing innovations in services and technology. This general goal must, of course, be made more specific for particular policy issues. In our review of the domestic satellite issue, we have concentrated on the following objectives:

Assuring full and timely benefit to the public of the economic and service potential of satellite technology.

Insuring maximum learning about the possibilities for satellite services.

Minimizing unnecessary regulatory and administrative impediments to technological and market development by the private sector.

Encouraging more vigorous innovation and flexibility within the communications industry to meet a constantly changing spectrum of public and private communications requirements at reasonable rates.

Discouraging anticompetitive practices—such as discriminatory pricing or interconnection practices and cross-subsidization between public monopoly and private service offerings—that inhibit the growth of a healthy structure in communications and related industries.

Assuring that national security and emergency preparedness needs are met.

THE TECHNICAL FRAMEWORK

The establishment and operation of domestic satellite communications facilities is technically feasible within the present state of the art, and readily foreseeable technological advances will further enhance this capability. Technical considerations place no serious constraints on policies governing the ownership or mode of operation (specialized or multi-purpose) of domestic satellite communications facilities. These technical considerations, though of great importance in the detailed engineering, operations, and economics of specific systems, can be dealt with effectively under any reasonably foreseeable ownership arrangements.

The issue of radio resource scarcity for satellite communications has been overstated to a significant degree. While the communications capacity of this resource is finite, the ability to accommodate additional radio services is greatly expandable through administrative, technological, and operational innovation. Both earth station and satellite design standards can be varied to assure adequate orbital capacity for both immediate requirements and likely near-term growth. Long-term growth can be accommodated through further refinement or additional frequency allocations, whichever is most economic.

Since some of the orbital locations and associated spectrum usage of interest for United States domestic satellites might also be potentially useful to other western hemisphere nations, a question of United States monopolization could conceivably arise. However, even 10 to 12 United States domestic satellites (a high estimate of likely early system development) would represent only a small fraction of the number which could be accommodated for western hemisphere use with the current state of the art. Therefore, orbital capacity is not expected to be a problem at this time. As demand for satellite communication expands, it may become necessary to evolve additional international coordinating mechanisms; but this would likely involve the establishment of appropriate technical standards rather than the rationing of orbital positions. This is expected to be a subject for discussion at the 1971 World Administrative Radio Conference.

### THE ECONOMIC FRAMEWORK

The most immediate potential for domestic satellite communications seems to lie in long distance specialized transmission services—such as one-way distribution of radio and television programs or two-way exchange of high-speed data or other wideband signals among thinly dispersed users. Common carriers have informed us that satellites do not appear economic at present for the routine transmission of public message traffic.

For the foreseeable future, satellite communications systems will require large initial investments, careful technical and economic planning, and complex technical management capabilities. The extensive, reliable, and low-cost terrestrial communications network already established in the United States makes domestic satellite systems competitive only where their unique capabilities offer significant advantages over terrestrial transmission. We therefore, expect the initial number of potential offerers of domestic satellite services to be small.

In the absence of clear economies of scale and overriding public interest considerations to the contrary, the American economy has relied on competitive private enterprise rather than regulated monopoly to assure technical and market innovation, long-run optimum use of resources, and industry flexibility. These are all conditions this Nation has found to encourage higher-quality, lower-cost services responsive to consumer demand.

At this stage of domestic satellite planning, it is not possible to identify major economies of scale. Rather, it appears that a diversity of multiple satellite systems as well as multiple earth stations will be required to provide a full range of domestic services.

Further, we find no public interest grounds for establishing a monopoly in domestic satellite communications. The general public is not a direct user of such services. The provision of specialized transmission services and the carriage of bulk message traffic are quite different in character from the provision of switched public message (telephone) service upon which much of our monopoly theory of telecommunications regulation is based. There is no reason to expect that competition here would do other than to encourage new or lower-cost services, the benefits of which would indirectly accrue to the public. Competition in the offering of satellite services appears to hold forth greater benefit to the economy and the public than would a single chosen instrument.

Detailed regulation of service rates and commercial rates of return are similarly predicated on natural monopoly conditions that should not exist with domestic satellite communications in the immediate future. Not only is competitive entry possible, but terrestrial communications pricing would act as an upper limit on prices chargeable for most satellite services. In these circumstances, competitive pressure, rather than regulatory constraints, should be permitted to limit rates for specialized services via domestic satellites.

The historical development of telecommunications policy, regulation, and industry structure has resulted in a blurred distinction between public and private interests. A confusing patchwork of cross-subsidization between public message and specialized service offerings has become the norm rather than the exception.

Therefore, it is possible that satellite services could, through cost-reducing innovation and competition, cause some existing services now surviving on a cross-subsidized basis to become uneconomic. Even if the benefits of such cross-subsidization accrue to the public users rather than to private service offerings, however, there seems to be no merit in protecting suppliers of such services from fair competition. The primary impact of such competition should be the provision of those services through lower-cost alternatives. Should such competition result in curtailment of some public services that are necessary as a matter of public policy, however, a direct public subsidy would in most cases be less costly to the public than forced cross-subsidization and restraint of competition.

RECOMMENDATION

Government policy should encourage and facilitate the development of commercial domestic satellite communications system to the extent that private enterprise finds them economically and operationally feasible. We find no reason to call for the immediate establishment of a domestic satellite system as a matter of public policy. Government should not seek to promote uneconomic systems or to dictate ownership arrangements; nor should coordinated planning or operation of such facilities be required except as essential to avoid harmful radio interference.

Subject to appropriate conditions to preclude harmful interference and anti-competitive practices, any financially qualified public or private entity, including Government corporations, should be permitted to establish and operate domestic satellite facilities for its own needs; join with related entities in common-user, cooperative facilities; establish facilities for lease to prospective users; or establish facilities to be used in providing specialized carrier services on a competitive basis. Within the constraints outlined below, common-carriers should be free to establish facilities for either switched public message or specialized services, or both.

The number or classes of potential offerers of satellite services should not be limited arbitrarily. Nor should there be any a priori ranking of potential types of systems (common-carrier vs. specialized carrier vs. private; or satellite vs. terrestrial). Only in the event that specific applications pose immediate and irreconcilable conflict in the use of radio and orbital resources would an a priori public interest exclusion of proposals be warranted. In particular, the potential economic impact of private or common-user satellite systems on terrestrial common carriers or specialized carriers should not be a factor in the authorization of such systems.

All prospective entrants should be afforded equal opportunity to establish and operate domestic satellite communications facilities by adoption of the following guidelines:

(1) Facilities to be established by independent entities for their own private use should be required to demonstrate only the financial and technical qualifications to implement their system proposals. There is no valid public interest requirement in such cases to require a showing of economic viability or optimization, nor should the potential economic impact of such operations on common or specialized carriers be a factor in the authorization of such facilities.

(2) Facilities to be established as part of a common-user cooperative system should be authorized in accord with the same principles as for fully independent facilities. However, to avoid restraints on competition, the opportunity should be made available for all potential users of similar services to participate without discrimination in such cooperatives as a condition of their authorization.

(3) Facilities to be used by specialized carriers (i.e., carriers having no monopoly over switched public message services) should be authorized under essentially the same terms and conditions as private or common-user facilities. Furthermore, such specialized carriers should not be constrained to serve as a "carrier's carrier" nor to share ownership of space or earth station facilities with other carriers. We also urge the Commission to allow competition to limit the rates charged for specialized services via satellite. Specialized carriers should, however, be required to serve similar users at equal rates and on a non-discriminatory basis.

(4) Facilities to be used by common carriers solely for the transmission of switched public message services should be authorized under the same terms

and conditions that apply for terrestrial radio facilities. However, facilities to be used by such carriers in the transmission of specialized message services should be authorized only after a determination by the Commission on each application, based on public evidentiary hearings, that no cross-subsidization between monopoly public message and specialized services would take place in the development, manufacture, installation, or operation of such facilities. This should not be interpreted, however, to preclude the legitimate economies of joint-use facilities.

(5) The use of leased facilities (satellite and/or earth stations) should be authorized under the same terms and conditions as owned facilities, with the responsibility for adherence to these conditions resting with the lessee. Rate-regulated carriers should be permitted to include a portion of the lease costs of such facilities in their rate base.

(6) Local communications common carriers should be required to provide leased interconnection services for user access to earth stations at reasonable rates and without discrimination.

(7) Potential harmful interference between satellite systems and terrestrial installations should be resolved by the Commission according to established procedures. Satellite operating entities should have equal status with terrestrial users in interference problems and in access to the radio spectrum. To accommodate new systems or services, the Commission should affirm its authority to modify or rescind, where appropriate, the operating rights of established spectrum users (satellite or terrestrial) where this would not significantly impair the quality of service or impose undue economic burdens; we believe the Commission should require compensation of the established users to be paid by the new entrant in such situations.

(8) The Commission may wish to establish a minimum acceptable earth station diameter, such as 30 feet, in order to accommodate an adequate number of initial United States domestic satellites in the 4 and 6 GHz spectrum allocations without excessive use of orbital resources. Although it is very unlikely that the number of satellites proposed during the initial filing period will approach the limit such a standard would impose, the standard should in that event be raised. Conversely, if applications were well below this number, and a reasonable case were made on economic and operational grounds, the standard could be relaxed in specific cases. To the extent possible within the state of the art, the satellite antenna radiation pattern should encompass only the specific land areas to be served.

In a time of rapid technological, economic, and social change, we would be ill-advised to adopt a definitive policy without the flexibility for future review or to adopt an overly restrictive policy simply because of our inability to predict future developments. We therefore recommend that the above policies be adopted on an interim basis, such as three to five years, to permit vigorous exploration and development of satellite service possibilities. During this period, the Commission should monitor the industry structure, service offerings, and rates to determine if natural monopoly or other conditions are developing that suggest more restrictive entry conditions or warrant direct rate regulation for specialized satellite services. At the end of the interim period, a full review of the policy and industry structure should be made.

It is most important that the establishment and operation of domestic satellite communications facilities be consistent with our obligations and commitments to INTELSAT and the International Telecommunications Union, with other foreign policy considerations, and with national security communications requirements. With respect to INTELSAT, it is particularly important that domestic systems not threaten the operational integrity or economic viability of the global services provided through that system. It is also important that provision be made for use of domestic satellite services by national security and emergency preparedness agencies when appropriate. We are satisfied that domestic satellite communications facilities authorized in accordance with the preceding recommendations will meet all these conditions. We further see no reason why the Communications Satellite Corporation, established by Congress as the chosen instrument for United States participation in INTELSAT, should not be permitted to compete for domestic satellite service on an equal basis under the above guidelines.

PETER FLANIGAN,
*Assistant to the President.*

FEDERAL COMMUNICATIONS COMMISSION,
*Washington, D.C., January 28, 1970.*

FCC CHAIRMAN DEAN BURCH HAS ISSUED THE FOLLOWING STATEMENT ON THE DOMESTIC SATELLITE PROPOSALS RELEASED TODAY BY THE WHITE HOUSE

The Commission has been anxious to proceed to a final policy determination in this most important proceeding. The United States must continue to show leadership in the field of satellite communications and to obtain domestically for the American people the full benefits of satellite communications technology as rapidly as possible. We therefore welcome receipt of the Executive's views. We intend to study carefully those views and the other submissions in the proceeding, and to arrive at an early decision. In short, this matter warrants and will receive the highest priority before the Commission.

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